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ABSTRACT

This report identifies and describes new directions for vocational, or career and technical, education in high schools at the beginning of the 21st century. It synthesizes the thought and opinion of a variety of stakeholders, gathered through interviews and a review of policy-influencing documents and research. It begins with an historical overview of high school vocational education. Forces influencing high school career and technical education are described: the new economy, public expectations, new cognitive science research about learning, and a variety of school reform movements. The purposes of high school career and technical education are identified as follows: providing career exploration and planning, enhancing academic achievement and motivation to learn more, acquiring generic work competencies and skills useful for employment, and establishing pathways for continuing education and lifelong learning. The importance of the early childhood and middle school years in laying the foundation for high school and beyond is emphasized. The paper elaborates four themes for the new career and technical education: career planning and development, high school reform, upgrading of vocational education, and the K-14 model. These themes are discussed in terms of six components, four that contribute to student achievement (high school majors, contextual teaching and learning, work-based learning, authentic assessment) and two that relate to the organization of schools and school systems (career academies and tech prep). (Contains approximately 110 references.) (SK)

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New Directions for

High School Career and Technical Education

in the 21st Century

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Information Series No. 384

by Richard L. Lynch

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New Directions for High School Career and Technical Education in the 21st Century

Information Series No. 384

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The Educational Resources Information Center Clearinghouse on Adult, Career, and Vocational Education (ERIC/ACVE) is 1 of 16 clearinghouses in a national information system that is funded by the Office of Educational Research and Improvement (OERI), U.S. Department of Education. This paper was developed to fulfill one of the functions of the clearinghouse—interpreting the literature in the ERIC database. This paper should be of interest to vocational education teachers, researchers, and policymakers.

ERIC/ACVE would like to thank Richard L. Lynch for his work on this paper. The paper was prepared while the author was on assignment to the U.S. Department of Education, Office of Vocational and Adult Education, from July 8, 1998 through June 30, 1999. Authority for the assignment was an agreement through the Intergovernmental Personnel Act and the Board of Regents of the University System of Georgia. Lynch is the former Director of the School of Leadership and Lifelong Learning and currently Professor of Occupational Studies, The University of Georgia. He has more than 30 years of experience in vocational education as a high school student and postsecondary teacher, teacher educator, researcher, and college administrator. He is the author of a related ERIC monograph, ***Designing Vocational and Technical Teacher Education for the 21st Century: Implications from the Reform Literature.***

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A new vision for vocational education is integral to comprehensive reform of the high school in the United States. This paper identifies and describes new directions for vocational, or *career and technical, education* in high schools at the beginning of the 21st century. It synthesizes thought and opinion of a variety of stakeholders, gathered through interviews and a review of policy-influencing documents and research.

The paper begins with an historical overview of high school vocational education in order to understand the present condition of the field, depicting the turn of the 21st century as a crucial crossroads at which important decisions for the future must be made. Forces influencing high school career and technical education at this stage are described: the new economy, public expectations, new cognitive science research about learning, and a variety of school reform movements. The purposes of high school career and technical education are identified as—

- Providing career exploration and planning
- Enhancing academic achievement and motivation to learn more
- Acquiring generic work competencies and skills useful for employment
- Establishing pathways for continuing education and lifelong learning

The importance of early childhood and middle school years in laying the foundation for the high school and beyond is emphasized.

The remainder of the paper elaborates four themes for the new career and technical education: career planning and development, high school reform, upgrading of vocational education, and the K-14 model. These themes are discussed in terms of six components, four that contribute to student achievement (high school majors, contextual teaching and learning, work-based learning, authentic assessment) and two that relate to the organization of schools and school systems (career academies and tech prep).

Information on the topics in this paper may be found in the ERIC database using the following descriptors: Career Academies, *Career Education, Early Childhood Education, *Education Work Relationship, Educational Change, Educational Improvement, Elementary Education, High Schools, Integrated Curriculum, Middle Schools, Tech Prep, *Technical Education, *Vocational Education. Asterisks indicate terms that are particularly relevant.

Overview

From Vocational to Career and Technical Education

Today, thousands of comprehensive high schools, secondary and postsecondary vocational and technical schools, career academies, and community colleges offer employment-related education programs and courses to prepare youth and adults of all ages for various careers. These programs and courses are designed to prepare these same youth and adults concomitantly for higher education and lifelong learning.

This is the essence of the "new" vocational education. It is academically rigorous. It is career relevant. It combines academics and career applications. It teaches students about **all** aspects of the industry. It teaches them how to apply high-level math, science, technology, and languages in workplaces and communities. It prepares them with the education and technical skills they will need for successful employment in various careers or professions.

The "new" voc ed in high schools also prepares students for college, should they and their families choose for them to attend. This vocational education at all levels (high school, technical school, community college) prepares students with the academic foundation to be lifelong learners. It does not replace nor substitute for academics; rather it enhances academics by bringing real-world context and application—especially targeted to workplaces—to education.

The new vocational education is characterized by a curriculum based on the need for students to demonstrate mastery of rigorous industry standards, high academic standards and related general education knowledge, technology, and general employment competencies. The curriculum is contextually based in that students demonstrate mastery of content through in-school projects or onsite work experiences (i.e., in businesses, industries, hospitals, offices), or through various portfolios, exhibits, or other authentic assessment methods. Students' work is assessed and "scored" on criteria that are often based on standards in workplaces and established collaboratively by teachers and employers.

The new vocational education is integral to comprehensive reform of the American high school. The general public, policymakers, business coalitions, and many educators themselves have increasingly (and sometimes loudly) called for comprehensive reform of high school curriculum and instruction. Reformers demand tough standards, a rigorous but relevant curriculum, "better" teaching, safe and disciplined schools, and outcomes that will enhance students' competitiveness in workplaces while simultaneously preparing them for college-level academic work.

The nomenclature for this new 21st-century vocational education varies among states and localities: technical education, vocational education, applied technology education, career education, work force education, or applied education. Some states or localities use these names (or others) in combination, such as vocational and technical education,

career and technical education, career and professional education, or work force education and development. In fact, as many as 200 different names were found in use at state or local levels by the American Vocational Association (AVA). In December 1998, the members of the Association for Career and Technical Education (ACTE—formerly AVA) voted to use *career and technical education* as the moniker that best describes their work and profession and to identify their association. ACTE is the largest national vocational education organization, and its board members and staff are encouraging other organizations and government agencies to remove "vocational education" from titles, policy documents, and legislation and replace it with *career and technical education*.

States and localities continue to receive federal funds for career and technical education from several sources, such as the Carl D. Perkins Vocational and Technical Education Act of 1998, the Workforce Investment Act of 1998, and the School to Work Opportunities Act of 1994. But the career and technical education of today in most places is (or should be) vastly different from the vocational education developed in this country just prior to the turn of the 20th century and funded originally through the Smith-Hughes Act of 1917. This act and subsequent legislation up to 1998 defined vocational education, for the purpose of receiving federal funds, as preparation for occupations requiring other than a baccalaureate or advanced degree. Recognizing the growing economic importance to students and employers of college and continuing education, the federal government today emphasizes using federal funds to support state and local efforts to develop challenging academic standards, integrate academic and vocational instruction, and link secondary and postsecondary education.

Purpose of the Paper

The purpose of this paper is to identify and describe new directions for *career and technical education* in American high schools in the first decade of the 21st century. The nomenclature may indeed vary, but the essential purpose is to describe an appropriate education and experiences needed by high school students to prepare them to enter employment upon graduation and/or to continue studying in postsecondary institutions at that time or later in their lives. The paper is a review and synthesis of creative thought, opinion, policy-influencing documents, research, and reflective thinking from a plethora of stakeholders involved generally with high school education in the United States and specifically with career and technical education.

Methodology

New directions provided in this paper have been drawn extensively from research studies and literature in vocational education, especially those that began to appear in the early 1990s and through the final decade of the 20th century. In addition, position papers and other documents from many education groups, trade and professional organizations, state and local school systems, businesses or business coalitions, and government were provided and reviewed.

Extensive conversations were held with participants at state and national conferences about directions for high school vocational education. These included the annual conferences of the National Association of State Directors of Vocational and Technical Education Consortium, the American Vocational Association (now known as the Association for Career and Technical Education), and the American Association of Colleges for Teacher Education; three regional conferences on *Improving America's Schools* sponsored by the Secretary of Education; and two state conferences.

Face-to-face and telephone interviews were held with many business persons, representing a range of industries; trade and professional association executives and staff; public school administrators; state directors of career and technical education programs; university deans and faculty; government officials; and other individuals known to have published about and/or advocated widely for career and technical education.

Open-ended responses about the vision of work-based education and related teacher education were received through postal mail and/or e-mail from over 200 individuals. Some attached or mailed written materials about their organization's hiring policies, practices, and expectations. Some included sections from their state or local school system's strategic plans related to career and technical education. Nearly all contributed their opinion on direction or "vision" for career and technical education in the next century.

A more detailed description of background and methodology is included in the appendix. It is noted that the literature and research review, interviews, conference presentations and conversations, and review of written strategic plans, positions, and thoughts took place from July 1998 through June 1999. Subsequently, drafts of written sections or a draft of an executive summary of the paper have been reviewed by stakeholders—including the 50 state directors of career and technical education. Presentations of proposed directions have been given to several groups at national, state, and local conferences. Where appropriate, comments from reviewers and participants at conferences have been included in this paper.

Sharpening a Vision for Career and Technical Education

The original intention of this paper was to produce a *vision* for career and technical education for the 21st century. Typically, a vision for a company or an organization is something not yet real, but imagined, growing out of unusual discernment or foresight. The employees or members of the organization understand the vision and believe it to be correct and that its inherent definitions, goals, programs, and activities are attainable.

At this point, it probably cannot be stated unequivocally that there is *the* (or even *a* relatively consensual) vision for high school career and technical education, at least at the national level. However, the background, research, and specific directions provided throughout the paper, collectively, should aid policymakers and program developers in sharpening their own or their institution's vision for high school career and technical education for the first decade of the 21st century.

Overview

The second section of the paper provides a historical overview of vocational education, from its inauguration as a federally funded public education program in 1917 to its present condition in schools at the end of the 20th century. Four schools of thought seemingly prevalent in the literature and discussed among stakeholders are presented:

1. Emphasize throughout the curriculum "education through occupations" whereby *career and technical education* serves as an educational/ instructional modality for teaching traditional academic content.

2. Retain the "best" of the historic and successful vocational education programs by focusing on specific job skills taught to about one-third of graduates who do not wish to prepare for or attend college—at least immediately after graduating from high school.

3. Provide career and technical education primarily to the 8-12 percent of the nation's most educationally disadvantaged students who need extensive job training to enter the labor market upon high school graduation.

4. Organize the career and technical education delivery system congruent with contemporary and successful models of tech prep.

The third section grounds reform in high school career and technical education by discussing four macro developments: (1) significant changes in the economy that call for major changes in the education and skills of the present and future work force and the need for students to prepare for this "new" economy; (2) greater demand from an increasingly vocal public for new and better education for *all* of the nation's youth; (3) relatively new research into student learning and achievement—much of which challenges long-standing practices of how youngsters learn and can be taught to learn more; and (4) reports from prestigious student and reform groups delineating important and needed changes in high schools.

These four significant developments provide the framework for further delineation of purposes for high school career and technical education: Through the career and technical education delivery system, high schools should—

- Provide career exploration and planning,
- Enhance students' academic achievement and motivation to learn more,
- Enable student to acquire generic work competencies and skills useful for employment, and
- Establish pathways for continuing education and lifelong learning.

The fourth section calls for career and technical educators to partner early and often with educational colleagues to teach children, youth, and adults to learn and to impress upon them the importance of learning and the criticality of becoming lifelong learners. A considerable body of relatively new knowledge from brain research and cognition informs parents and teachers about how individuals learn, remember, think, perceive, form associations, construct knowledge and meaning from new information, transfer

knowledge, and make sense out of that which they read, see, hear, and perceive. This new knowledge calls for important changes in elementary and, especially, middle school education that, in turn, should help provide students with a solid foundation for learning and thus for high school career and technical education. In effect, research on cognition has found that effective teaching, in addition to mastery of appropriate content or subject matter, is critical to long-term, sustained learning.

The last section provides themes and components for a new or reformed career and technical education. Four themes were prevalent throughout the research and preparation of this paper:

1. Infuse career planning and development throughout the entire curriculum, from preK through lifelong learning. The essence of this theme is that all teachers (and parents) should be cognizant of applications of knowledge to real-world environments, especially workplaces.

2. Embed reform of career and technical education within the reform of the American high school. It is insufficient just to reform the "vocational education" curriculum without reforming other components of the high school system, curriculum, and instruction.

3. Develop more contemporary career and technical programs organized around the education and training needs of today's and tomorrow's industries and future career opportunities for students.

4. Prepare all students for postsecondary education and provide them the support to acquire, at a minimum, 13 and 14 years of education or its equivalent.

Drawing on these themes are six components—or parts or structures of the education enterprise, each of which should be considered at local and state levels when charting direction for the next decade of high school career and technical education. Components 1-4 are intended to increase student learning, motivation, and achievement; 5 and 6 relate to the systems or organization of the high school.

1. Organize programs, curriculum, and instruction around major fields of studies, similar to majors typically identified in colleges and universities.

2. Bring to scale in high schools more contextual teaching and learning throughout the curriculum.

3. Infuse considerably more substantive work-based learning, ensuring that work-based activities are solidly grounded in the curriculum and contribute to mastery of standards.

4. Assess authentically students' progress toward meeting education standards.

5. Increase the use of career academies.

6. Adapt, at the state or local school system levels, the successful models of tech prep.

High School Vocational Education: Past and Present

Historical Overview

> No force has been more powerful in man's rise from savagery to civilization than work. (Roberts 1957, p. 5)

Let's acknowledge that education for and about work began at the very beginning of civilization with the creation or evolution of humankind. It was, of course, at the hands of parents—the true teachers, or meisters, or master tradesmen—who in turn passed on their knowledge and skills to their children. The earliest prehistoric artifacts available today show a man working with implements more than 50,000 years ago and passing on his knowledge to a "student." Even the highest acclaimed professions of today—astronaut, physician, philosopher, clergy—are most essentially about work and all call for a solid education and job skills to prepare them well for the tasks, duties, and responsibilities of the job. So, indeed, vocational education (or career and technical education) is ubiquitous.

However, the general discussion of vocational education in the United States focuses on that which has evolved in response to federal legislation. Beginning in 1862 (and again in 1890), Congress passed the Morrill Acts providing aid to higher education for land-grant colleges. The Hatch Act of 1887 and the Adams Act of 1906 allocated aid to agricultural experiment stations, and the Smith-Lever Act of 1914 provided support for agricultural and home economics extension programs (Roberts 1957). These acts helped to democratize the land-grant colleges and began the practice of federal subsidies to education (Roberts 1957; Swanson 1951).

The beginning of the major federal influences in molding and shaping secondary and postsecondary (i.e., subbaccalaureate level) vocational education began with the Smith-Hughes Act of 1917. This legislation was devised in response to a complex set of social, economic, and political forces. In particular, it was enacted to prepare youth for jobs resulting from the industrial revolution and to provide them with an alternative to the general curriculum of schools, which were "too exclusively literary in spirit, scope, and methods" (Swanson 1951, p. 16).

Smith-Hughes provided for a continuing appropriation for vocational education in agriculture, trades and industry, and home economics (homemaking) and for teacher training in each of these fields. Funds were appropriated for the administration of the program at the national level. In essence, Smith-Hughes provided for an alternative high school education from that typically provided at the time for middle and wealthy classes of students. The Smith-Hughes Act emphasized separatism from the classical curriculum and called for a new one that would better meet the needs of the children of the working

class, who, for the first time, were attending high school but were not headed for the professions (Gray 1991).

The Smith-Hughes Act provided for a Federal Board for Vocational Education and separate state boards. Each state was required to submit a state plan for federal vocational education funding and to agree that (1) the federally aided program of vocational education would be under public supervision and control, (2) the controlling purpose would be to fit students for useful employment, (3) vocational education would be of less than college grade and designed to meet the needs of persons over 14 years of age who had entered or who were preparing to enter the occupation for which they were receiving training, and (4) the state or local community would provide the necessary plant and equipment (Roberts 1957, p. 132).

It is important to note, as historical context, that the Smith-Hughes Act established vocational education with a separate board from that of the state board for "regular" (i.e., classical) education as well as with separate funds, separate teacher preparation and certification, separate students, and separate and segregated curriculum. The Federal Board mandated the 50-25-25 rule: 50 percent of students' time in shop work, 25 percent in closely related subjects, and 25 percent in academic courses (Hayward and Benson 1993). The intent was, of course, to separate vocational students from those in the classical curriculum and prepare them well for the factories, farms, and homes of the era. And, as is well known, the state plan is still a required prelude to receiving federal funds to support state leadership and local programs of vocational education.

Since the beginning of this separatism in 1917, vocational teachers have predictably emphasized job-specific skills, almost to the complete exclusion of theoretical content (Hayward and Benson 1993). Program areas or fields of study matching the specific industrial categories called for in the legislation were developed and have persisted with great gusto over the past 80 years and others have been added: distributive education, business education, health occupations, technical education, occupational home economics (focused on wage-earning job preparation in contrast to the original act, which focused only on homemaking), and industrial arts. Thus each of these areas (although several now have different names) were developed with separate teacher certification or training programs, usually separate state administrators and often separate local supervisors, sometimes with separate (but relatively small) pots of funds, separate teacher organizations, separate youth clubs or organizations, and separate lobbyists for federal and state funds. These separate programs, especially through their teacher and youth organizations, became very powerful and influential.

Until recent years, all states had large (at least compared to fine arts and academic subject areas within education) and influential program area state supervisors and a designated state director (and staff) for vocational education who had responsibilities for program development, curriculum development, teaching and learning, youth clubs, research, assessment, etc. Probably one of the reasons these state staffs became so relatively large and powerful is that some of their salaries and related administration costs were often paid 100 percent with federal funds. Since 1990, there has been quite a

decline in the numbers of state staff working just in the area of vocational education in most of the states, as the percentage of each state's federal grant that could be used for state administration has been reduced significantly.

The strong federal influence on the development, growth, and nurturing of vocational programs largely remained unchanged throughout the years. Federal policy still looms large in comparison to the relatively small amounts of money the federal government contributes to support vocational education at the local school level—estimated to be only about 6-7 percent on a national average, although the percentage is much higher to support separate vocational high schools or area vocational centers.

Programs in vocational education at the local level were primarily controlled and operated by vocational educators for vocational education students, under the justification that it was vocational education money. Many vocational education programs did not (and still do not) come under the same general school scrutiny or supervision as general and academic subjects or even fine arts and physical education programs. In fact, vocational education was not (and still is not) often on the "radar" of general education policymakers, principals of comprehensive high schools, or school system superintendents. Historically, the direction for vocational education has almost exclusively come from the practitioners themselves *or* the federal government.

The earliest vocational programs were grounded primarily in the need to prepare more immigrants and blue collar-type workers with practical skills for the nation's farms, factories, and homes. The focus of federal legislation shifted over the years to ask states to offer programs and training to support national defense efforts (1920s), reduce unemployment problems (1930s), assist the war effort (1940s), include junior (now most are called community) colleges in the 1950s, and shift industries to peacetime economic development in the 1950s and 1960s. But the general thrust of federal policy and funding was to train boys and girls for jobs in the economy.

A significant change in federal policy and direction began in the early 1960s with passage of the Vocational Education Act of 1963. The federal government stepped up influence over state plans by including set-asides, most predominantly to serve poor and disabled persons and youth in economically depressed communities who had academic, socioeconomic, or other disadvantages that prevented them from succeeding in regular vocational education programs. Later amendments in 1968 and 1972 continued set-asides to expand Congress' leverage for vocational educators to serve students with disabilities, disadvantaged students, bilingual students, postsecondary students, and students preparing for occupations not traditional for their gender.

In 1984, Congress passed the Carl D. Perkins Vocational Education and Applied Technology Act, the forerunner of today's federal legislation. The Perkins Act contained two main objectives: (1) the improvement of vocational programs and (2) better services and increased access to vocational education for students with special needs. These two goals proved to be both ambiguous and overly ambitious, given the state of the economy and the state of education at the time. The original Perkins Act set aside 57 percent of the federal grants to states for disadvantaged groups of one form or another and 43 percent

for something called "program improvement." In the late 1980s and early 1990s, vocational education experienced unprecedented enrollment percentage increases from special populations as an increasing number of general student groups opted out of vocational education to take more academic courses and as funding favored inclusion of special populations in vocational education programs.

Perkins II (1990) and Perkins III (1998) made further dramatic shifts in federal direction for vocational education. Both of these pieces of legislation are essentially grounded in school reform and the mandate to use federal funds to improve student performance and achievement. Perkins II prescriptively called for programs to develop more fully "the academic and occupational skills of all segments of the population. This purpose will principally be achieved through concentrating resources on improving educational programs leading to academic and occupational skills competencies needed to work in a technologically advanced society" (Carl D. Perkins Vocational Education and Applied Technology Act Amendments 1990, p. 7). For the first time in federal vocational education legislation, emphasis was placed on academics and funds could be directed to "all segments" of the population. Tech prep programs were specifically funded.[1]

Perkins III (1998) continues the essence of Perkins II and the "program improvement" component of Perkins I. The federal focus continues to be on developing the academic, vocational, and technical skills of students through high standards and linking secondary and postsecondary programs. Much of the specific language setting aside a percentage of funds or actual dollars for special populations has been removed. States are to provide services to special populations to help them succeed in high-quality vocational education programs, but the federal government will not dictate what those services are to be. The federal government, however, will require each state to provide data on four core indicators of performance: (1) attainment of academic and vocational/technical proficiencies; (2) attainment of a secondary degree or General Educational Development certificate, proficiency credential in conjunction with a secondary diploma, and a postsecondary degree or credential; (3) placement in, retention in, and completion of postsecondary education or advanced training, placement in military service, or placement or retention in employment; and (4) participation in and completion of programs that lead to nontraditional training and employment.

It seems increasingly clear that we have almost come full circle with federal direction of vocational education. The post-turn-of-the-century legislation was enacted to prepare more students with the type of education it was thought they would need to run farms and factories in the 20th century. Today, Perkins III challenges us to prepare more students with the contemporary education they will need to work successfully in ever-changing, technologically sophisticated, and internationally competitive workplaces. In essence, today's workplaces call for an increasingly educated work force for the 21st

[1] Congress' intent in funding tech prep in Perkins II was to provide planning and demonstration grants to consortia of local education agencies and postsecondary educational institutions to develop and operate coordinated programs (2 years secondary-2 years postsecondary) with required academics and technologies and articulation agreements designed to lead to an associate degree or certificate in a specific career field. More detail is provided about tech prep in subsequent sections of this paper.

century. The major difference is that as a society it is no longer economically sound to track and separate students into those with only (or primarily) a classical curriculum and those with only (or primarily) a vocational curriculum or with relatively narrow, job-specific skills. Both the head and the hands and the theoretical and applied will be needed by most students in most workplaces at some point in their lives.

Present Condition of High School Vocational Education

As mirrored in the larger, complicated society and in its public education system, vocational education in the United States is diverse, large, and complex. It encompasses a great variety of programs designed to equip students with work and life skills. It is offered by more than 33,500 public and private institutions.

In public secondary schools, one or more courses identified with vocational education are offered in 93 percent of the nation's 15,200 comprehensive, grades 9-12 high schools. Nearly all of these high schools offer introductory courses taught for purposes of *general* labor market preparation or to provide students with practical or life skills, such as typing or word processing, technology education (formerly called industrial arts), or family and consumer sciences (formerly called home economics).

About 75 percent of all comprehensive high schools offer *specialized* courses in one or more occupational programs, historically identified as agriculture, business and office, marketing, health, family and consumer sciences—occupational or wage earning, trade and industrial (which may consist of many specialties ranging from cosmetology to construction to mechanics and repair skills), and technical and communications (Boesel, Hudson, Deich, and Masten 1994). More recently, the federal government has added public and protective services, child care and education, food service and hospitality, technology and communications, and personal and other services to its classification of vocational or occupational program areas (Levesque, Lauen, Teitelbaum, Alt, Librera, and Nelson 2000). Fewer than 5 percent of comprehensive high schools offer courses from more than 6 vocational education programs (Hayward and Benson 1993).

More extensive specialized programs (particularly in trade and industrial) tend to be concentrated in some states in area vocational centers or vocational high schools to better accommodate the extensive facilities, workshops and laboratories, and equipment that are often needed and to offer greater depth and breadth of training for some occupational areas (Boesel et al. 1994). There are about 1,100 area vocational centers nationwide where high school students attend part of the day or evening for specialized vocational programs and attend their "home" high school for academic or general courses during the other part of the day. Where area vocational centers are available, the home or comprehensive high school typically does not offer extensive specialized vocational programs. In addition to area vocational centers, there are about 250 vocational high schools in the United States that focus on preparing students for work in a particular occupation or industry, but offer the academic and general courses at the school as well. Students attend this type of vocational high school full time (Boesel et al. 1994).

Public postsecondary vocational education is provided by 720 degree-granting community colleges, 162 technical institutes or colleges that grant degrees in technical fields, 504 postsecondary area vocational schools that do not grant degrees, 308 postsecondary schools serving only 1 industry, and 70 postsecondary skills centers for disadvantaged youth. In addition, there are approximately 2,400 private postsecondary schools offering vocational programs or courses (Hayward and Benson 1993).

To help explain the seemingly hodge-podge state of vocational education throughout the United States, it is important to note that public education is almost exclusively the responsibility (and related authority) of the 50 states and territories. Further, the states (with few exceptions) have determined that most education decisions are best left in the hands of locally elected school boards, and these boards are the ones considered best equipped to make education decisions for the students in their communities. Even within school districts, there often is great variability, and many curricular and instructional decisions are made at the individual secondary or postsecondary site. In fact, site-based management and decision making is the profferred governance mode on several prominent school reform agendas. These responsibility and authority aspects, and related education governance and control issues, are often hotly debated as educators struggle to implement reforms that may (or may not) be based on research, data, theory, opinion, rhetoric, political influence, special interests, and so on.

As Hayward and Benson (1993) noted, these state and local control factors have resulted in a vocational-technical system in the United States that lacks the attributes normally associated with a "system." There are no national (and often no state) standards of skill development, no minimal or meaningful level of performance expected, no uniform curriculum, no consistent standards or expectations for teacher licensure, no uniform reporting system, and no (as yet) agreed-upon accountability system. In contrast, though, most state legislators have dictated the requirements for the high school college prep curriculum, or colleges and universities have, in a de facto sense, set national standards by insisting that students complete a set of courses (core academic curriculum) and perform at a particular level on a standardized test administered *nationally* either by ACT or Educational Testing Service before being admitted to universities.

Student enrollments in high school vocational education had their heyday in the 1960s and 1970s. In the 1980s, enrollments began a downward spiral that just recently may be reversing itself. Although there was a general overall decline in high school student enrollments during the 1980s and early 1990s, the proportionate decline in vocational education was much steeper.

Various state studies conducted in the late 1980s concluded that as much as an overall 50 percent drop in secondary vocational education enrollment was related to an increase in students' enrollment in academic courses and a declining enrollment in the overall high school population. The National Center for Research in Vocational Education (NCRVE) reported that 31 states experienced steady declines in vocational enrollments from 1983 to 1990 (Husain 1999).

During this period and into the early 1990s, the decline in vocational education enrollment from high school students was significantly greater than that which could be explained by the shrinking high school student population. Combined with the decline in the overall high school student population and the increase in overall Carnegie[2] credits earned by students, the 1994 National Assessment of Vocational Education concluded that an overall 33 percent decline in the demand for vocational education occurred between 1982 and 1994. The good news is that at least 97 percent of all 1992 high school students did enroll in at least one credit course identified as vocational education (Boesel et al. 1994). The bad news is there was a significant decline in enrollment classified as vocational educational concentration[3] and specialization[4] (Levesque et al. 2000).

The following is a summary, extracted from various government data sets, of high school students' participation in vocational education with a focus on enrollment patterns and trends from 1982-1994:

Credits. From 1982-1994, the average number of vocational credits earned by a high school graduate fell from 4.7 to 4.0. In 1982, the proportionate share of vocational credits to total credits was 22 percent; this fell to 16 percent by 1994. During the same period, the total amount of coursework completed by public high school graduates increased, on average, from 21.6 credits in 1982 to 24.2 credits in 1994, an increase of 12 percent (Levesque et al. 2000, pp. 49-50).

Vocational Concentrators. The percentage of graduates taking three or more courses in a single occupational program area decreased from nearly 34 percent in 1982 to 25.5 percent in 1994. The latter figure includes 4.5 percent of the 1994 graduates who also completed a college preparatory curriculum as well as the 20.9 who completed only the vocational concentration (ibid., pp. 51-53, 65). Of 100 high school graduates in 1982 and 1994, the following is the percentage who completed 3 or more credits in each of the vocational programs:

Program Area	1982	1994
Agriculture	2.8	3.2
Business	11.6	7.7
Marketing	1.8	2.2
Health Care	0.6	1.0
Trade and Industrial	14.8	8.5
Technology and Communications	0.5	0.9
Occupational Home Economics	1.7	2.0

[2] A Carnegie unit or credit is a standard of measurement used for high school education that represents the completion of a course that meets 1 period per day for 1 year.

[3] To be classified as a concentrator, a student must complete three or more courses in a single occupational program area, such as agriculture, business, or health.

[4] To be classified as a vocational specialist, a student must complete four or more courses in a single occupational program area with at least two of those courses beyond introductory level.

For those classified as vocational education concentrators, enrollments were distributed among the various programs as follows (Levesque and Hoachlander 2000):

Program Area	1982	1994
Agriculture	8.0	12.0
Marketing	5.0	8.0
Health	2.0	4.0
Technology and Communications	1.0	3.0
Food Service and Hospitality	.7	1.4
Child Care and Education	1.0	2.0
Business	34.0	30.0
Trade and Industry	44.0	34.0
Personal Services	4.0	4.0
Other/NA	.3	1.6

Segmented data show that, with the exception of special populations, males, females, African-Americans, Hispanics, American Indian/Alaskan Natives, and whites from rural, suburban, and urban areas all decreased their rates of vocational concentration in public high schools during this period (Levesque et al. 2000, p. 61).

Vocational Specialists. The percentage of graduates taking four or more courses in a single occupational program area, with at least two of those courses beyond the introductory level, declined from 13 percent in 1982 to 7 percent in 1994 (Levesque et al. 2000, p. 51).

General Vocational-Specialized. The percentage of public high school graduates taking at least one vocational education course (general or specialized) decreased slightly from 98.2 percent in 1982 to 97.2 percent in 1994. The percentage of graduates taking at least one specialized labor market preparation course increased slightly from 88.7 percent in 1982 to 90.8 percent in 1994; however, the average amount of coursework in specialized courses taken by high school graduates decreased from 3.0 credits to 2.8 credits over the same period (ibid., pp. 50-51).

Special Populations. Generally, students who took four or more Carnegie credits (vocational specialists) from any one program area, including family and consumer sciences, were from special populations: single parents, Native Americans, disabled, limited English proficient, lowest 25% on socioeconomic status, below a C grade point average, in need of 2 or more remedial credits, and in the bottom 25 percent on standardized tests (Boesel et al. 1994, p. 18). Similarly, enrollment trend analysis shows increasing percentages of concentrators (three or more credits) among students with disabilities and lower grade point averages (Levesque et al. 2000, p. 56).

College Prep-Vocational. The percentage of public high school graduates completing both a vocational concentration and a college preparatory curriculum increased 7.5 times from 0.6 in 1982 to 4.5 in 1994. The percentage who completed only a college preparatory curriculum increased from 8.1 percent in 1982 to 32.2 percent in 1994. The percentage of graduates completing neither a vocational concentration nor a college preparatory curriculum decreased from 58.2 percent in 1982 to 42.4 percent in 1994 (ibid., p. 65).

Among vocational concentrators, the percentage who also completed a college preparatory curriculum increased ninefold, from 2 percent in 1982 to 18 percent in 1994. These dual graduates tended to concentrate most heavily in three vocational programs: health care, business, and technology and communications. Among college preparatory high school graduates, the percentage who also completed a vocational concentration increased from 7 percent in 1982 to 12 percent in 1994 (Hudson and Hurst 1999).

Preliminary data today indicate that, after up to 2 decades of decline, secondary career and technical education is enjoying a resurgence in both image and enrollment, backed by program improvements, business-education partnerships, students' interest in learning about computers and technology, and a growing sense that students need some job skills in order to earn funds to continue their education (and thus dual enrollment in the college preparatory curriculum and a career and technical education program). ACTE's ***Techniques*** magazine collected 1998 secondary enrollment numbers from 39 states, 70 percent of which reported an increase in enrollment since 1990 (Husain 1999). Preliminary federal data from many state enrollment reports, comparing numbers from 1994-1997, showed that vocational enrollments had increased in all vocational areas except family and consumer sciences (nonoccupational) and technical subjects. These preliminary reports (unverified data) also indicated that student-teacher ratios had increased considerably during that period in all areas except technical.

Further, public elementary school enrollments have been vastly increasing. This surge is expected to result in an 11 percent increase in public high school enrollment between 1998 and 2008 and, probably, a parallel increase in enrollments in career and technical programs. Increases in these enrollment statistics also suggest that some career and technical fields might be facing teacher shortages in the near future.

It must be recognized, too, that enrollment numbers are a funny and fuzzy component from which to assess the status or condition of vocational education or career and technical education. As pointed out earlier, there is no national *system* of vocational education in this country. Therefore, collecting macro or national data and extrapolating trends from it are inexact and unreliable processes. In citing the work of Norton Grubb, a principal researcher with NCRVE, Husain (1999) noted: "Some states count students into a program only if they take three or more technical classes while others count them each time they take a technical class" (p. 17). States "determine enrollment differently" and some "only count a [voc ed] student enrolled in career and technical *schools*" (p. 15, italics added). This lack of uniform data and inability to establish significant cause-and-

effect relationships among student numbers, program and curriculum intensity, and possible impact hinders vocational educators in their accounting to Congress and in their assessment of program effectiveness.

The Crossroads

> Controversy has always swirled around vocational education. Lauded by the unsophisticated, panned by the professionals, and shunned by the upwardly mobile, vocational education has been the Lawrence Welk of public education—tolerated and occasionally patronized by the Establishment, but never really accepted. (Gray 1991, p. 438)

Vocational education, especially in high schools, is at a crossroads. Down one path seem to be successful programs that are technologically up to date, integrate rigorous academics with knowledge and skills needed for careers, have a good career pathway planned with and for students and their parents, prepare students concomitantly for employment and higher education, and are well respected in the community. Many such programs are shining examples of excellence and some have been showcased in many ways.[5]

Down another path are schools and programs that have failed to update and increasingly rely on larger percentages of their total enrollment from disadvantaged populations but may not be well staffed or equipped to serve special populations well; their students are succeeding in vocational programs without fully understanding the insufficiency of the curriculum to prepare them either for good employment or further education (Oakes, Selvin, Karoly, and Guiton 1992). Sadly, many high school vocational programs are actually isolated from the workplaces for which they are allegedly preparing students (Grubb, Kalman, Castellano, Brown, and Bradby 1991). These are the programs that unfortunately, often loom large in the perception of much of the general public.

In some respects, these are tough times for secondary vocational education relative to direction. At least four schools of thought, seemingly in separate camps, on the direction of high school career and technical education are present in the literature and were discussed by persons interviewed for this paper:

1. "Education through occupations" where career and technical education is recognized as an educational/instructional modality for teaching traditional academic content. It is the pedagogy historically identified with vocational education that is recognized as effective for many students. This view, closely aligned with those who advocate the integration of academic and vocational education, seems to be the preferred direction emanating from the scholarly community.

[5] See, for example, the monthly issues of ***Techniques*** magazine, published by the Association for Career and Technical Education, which regularly features excellent programs and practices throughout the country. Also, the U.S. Department of Education's Office of Vocational and Adult Education has identified 28 new American high schools, all of which include examples of excellent career and technical education programs and career preparation for students.

2. Job skills for about one-third of high school graduates who are not college bound upon graduation. Focus is on instruction around broad career clusters along with specialized skills; that is, students will acquire knowledge of all aspects of an industry but will exit high school with some fairly specific job skills. This appears to be the preference in direction from practitioners in the traditional vocational education subject areas.

3. Concentrated preparation in specialized job skills targeted primarily to the 8-12 percent of educationally disadvantaged students who, in all likelihood, will not attend college and who need extensive job training to enter the labor market upon high school graduation. Vocational education is also identified as a good arena for alternative students who do not do well in traditional schools to prevent their dropping out before completing high school. This view of vocational education seems most embraced by many educators of academic subjects, middle- and upper-class parents, and some local policymakers.

4. Tech prep—an articulated agreement between high schools and postsecondary institutions (could include 2 years of high school + 2 years of community college + 2 years of baccalaureate) to provide programs in nonduplicative, sequenced study that integrate academic with career and technical education, use work-based and worksite learning, and lead to degrees, certificates, and career placement. This direction seems most favored by Congress and by business persons.

For some, the separate vs. integrated issue looms large as one group prefers and another group abhors the separation of vocational education from academics.

Indeed, there are mixed signals being sent to vocational and other educators about high school vocational education. On one hand are some local boards of education, school administrators, counselors, and fellow teachers who view vocational education as an alternative for students who do not do well in the classical or academic curricula. They prefer to keep it that way. And thus we see vocational educators in many schools (as well documented in the 1994 National Assessment of Vocational Education) teaching (relatively low) entry-level job skills to students who are educationally disadvantaged in one or more ways.

Conversely, other groups—especially business and industry—expect much more from career and technical education, including graduates with solid literacy, numeracy, communication, technology, and general employability skills. From a business and industry perspective, a high school diploma has historically been and should continue to be benchmarked with reasonable academic proficiency and appropriate preparation for workplaces. Business persons and other community representatives are calling for input into standards development and assessment for high school programs and graduates, which should include standards targeted toward both academics and workplaces. This also seems to be the implied direction from the 1998 Perkins III federal legislation.

Most groups that have thus far championed reform in high school education—with the exception of the Southern Regional Education Board's network of High Schools That Work—have not given high priority to career and technical education. Interviews with groups focusing on high school education said in their own way, "It's really not been placed on our radar." Much of the education reform literature gives it short shrift and speaks only in general terms of preparing students for workplaces. It is clear, however, that the reform advocates see such preparation as delivered primarily through core academic subjects.

It was difficult to find up-to-date information about students, programs, or teachers involved with today's high school vocational education programs in the mainstream research and scholarly literature and databases. The academic community has largely ignored vocational education. As one noted researcher commented about education-related data collected through empirical studies and experimental research, "No one pays this field [vocational education] much attention."

Further, there is a strong and vocal group that has panned vocational education, especially because of its relatively close alliance with the federal School to Work (STW) Opportunities Act of 1994. According to some analysts, STW was originally designed primarily to raise the achievement (academic and vocational) of those high school students who were headed directly to workplaces upon graduation. But, some say, a bait-and-switch took place, and STW—in some places and by some advocates—became a program of vocational education designed for all students. Critics said that "dumbing down the curriculum and forcing everyone to participate" is not the solution to this country's education nor its economic woes (Innerst 1999, p. 115).

This "dumbing down the curriculum" and the "dumping ground" image of high school vocational education are almost omnipresent. Even vocational educators themselves often talk about the negative perceptions of vocational education, especially among their colleagues in public education, parents, and students themselves. Surveys of vocational educators continue to rank the "image problem" as high on the list of serious issues continuing to plague the field. In a review of articles in ***Techniques*** over a 10-year period, the many image messages surfaced. Examples: (1) programs are not seen as meeting the needs of students, employers, and the community; (2) during the 1980s and early 1990s, vocational education competed against other programs (and perhaps unfairly) for a shrinking student population; (3) vocational education is generally viewed as a dead end and only for high school students who never plan to go to college; (4) programs are often targeted to educationally disadvantaged students and designed to help keep them in school and get them a diploma; (5) an elitist view says any form or context of education for work is not appropriate for students aspiring to a 4-year college or university; (6) confusion exists about initiatives begun with funding from the School to Work Opportunities Act and their relationship to vocational education; (7) many parents have the general perception that vocational education programs should be offered in local high schools or vocational centers, but targeted for someone else's children; and (8) vocational education will inhibit rather than enhance youth's career and educational choices (Catri 1998; Ries 1997; personal interviews).

Image problems are not easily erased. Some facts and observations from researchers indicate that even solid programs close because of poor student participation, despite school board and employer support for the program. Local businesses want to participate and employ students, but the high schoolers just aren't signing up. Lack of support from other teachers and counselors for such enrollment may be another obstacle (based on preliminary data from Jobs for the Future and the Institute on Education and the Economy at Columbia University Teachers' College). "Some teachers still believe that students are missing the 'real work' of the classroom when they leave the school to go to a workplace" (***Vocational Training News***, April 1, 1999, p. 3). Thus, changing the image will be a challenge for career and technical educators.

It certainly is not all negative. In some respects, these are good times for a new career and technical education. As discussed more thoroughly in the next section, the general public supports education targeted toward careers and employment as an essential purpose of public schools. Businesses and industries seems more willing than at any other time since the early 20th century to partner with public education to find solutions to what they perceive as the dismal preparation students are receiving for workplaces. Several years of research and development on the integration of academic and vocational education are finding positive results for more students. In 1998, Congress passed Perkins III, which encourages and supports a wide variety of initiatives and activities within the 50 states to improve programs to increase students' career *and* academic preparation. It was certainly Congress' intention to ensure that education programs respond to the economic and employment realities faced in the economy and by students.

Further, there is substantial optimism on the horizon that career and technical education may enjoy attention and rebirth from mainstream educators. For example, 48 of the nation's 51 chief state school officers recently responded to a survey asking them to identify the most critical issues facing public education in the years 2000 and 2020. The number 1 issue, chosen by 81% of the chiefs, was student preparation for the workplace (Morgan, Matranga, Peltier, and Hill 1998).

The original Perkins legislation and late 1980s and early 1990s education reform reports told us that students, educationally disadvantaged students in particular, were not going to improve their lot much without a solid education and that program improvements in vocational education were going to have to include healthy doses of academics, more and longer participation in programs, more involvement from business and industry, better teaching, better support services, and greater attention to soft or employability skills (Lynch, Smith, and Rojewski 1994). This message continues today.

Can the *new* career and technical education make the necessary adjustments so as to be responsive to career preparation *and* contribute to students' academic achievement and thus enhance success in postsecondary education *and* workplaces? It is increasingly clear that it cannot do both nor will its image improve, unless the substance (i.e., rigorous and authentic curriculum, instruction, and assessment) of most programs changes and unless career and technical education becomes more mainstream to the mission, planning, and operation of American high schools. This will involve significant changes in many pro-

grams. As summarized with clichés from interviewees for this project, it can't be "mere tinkering" or "minor adjustments on the margins of change," or "pouring new wine in an old bottle."

Related questions: Will career and technical educators accept any "national" system of assessments, measures, and rubrics to benchmark their programs and/or their students' achievements in employability and other workplace skills? Will general educators and the public accept (these) alternative assessments as among legitimate accountability measures for evaluating improved student performance and/or overall achievement?

Further, if and when changes are made, career and technical educators will need to step up advocacy for the programs with mainstream educators, parents, and students and those responsible for educational public policy. This advocacy will need to be well grounded in knowledge and research of the economy, educational ends and purposes, student learning and motivation, school reform issues, effective practices, and important components in a high school education that seem to make a difference in advancing student career and academic achievement. The remainder of this paper is intended to help provide this grounding.

Two fundamental premises (perhaps biases of the author) undergird the remainder of the paper:

1. High school career and technical education needs to be integral to mainstream school reform and placed on the radar of *all* who are working to improve the education of high school students.

2. Career and technical education can and must contribute to increased student achievement; but to do so, improvements need to be made in many existing programs to make them more effective and acceptable to the general public, new programs may need to be designed, and some old programs need to be put to rest.

A View toward the 21st Century: The Grounding of High School Career and Technical Education

> High schools must make it part of their mission to help young people understand that life without the intellectual tools for fully participating in the marketplace constitutes a sentence to likely destitution. (National Association of Secondary School Principals 1996, p. 3)

The "new" vocational education, described hereafter as *career and technical education*, is grounded in the writings, research, and agendas of many authors and scholars, reform groups, parents' and the general public's expectations for schools, and coalitions established for the purposes of high school or whole school reform. Many business coalitions and economists continue to address the realities and challenges of the changing 21st-century global economy and the related need for education and skills considerably different from those needed for the 20th-century economy. Parents and communities, too, are being increasingly vocal about their expectations for their children and their schools. Nearly all parents want their children to attend college, and they expect their public schools to prepare them to do so. But they also want the schools to provide their children with career education and prepare them with the knowledge and technical skills to be successful in contemporary workplaces.

We've learned much just in the past 20 years from research on student learning, motivation, and achievement that confirms the importance of contextualizing curriculum for most students most of the time. A defining condition of being human is that we have to understand the meaning of our experience and thus the meaning of our education.

There is an increasingly growing body of knowledge from the effective schools literature that calls for contemporary changes in public school systems, curriculum, instruction, and outcomes that also is helping to inform changes in career and technical education. These several forces are commingling, in some fashion, to form a new philosophy and purposes for career and technical education.

The New Economy

> The factory of the 21st century will be between our employees' ears. (Vance D. Coffman, Chairman and CEO, Lockheed Martin Corporation for the National Alliance of Business)

From Businesses' Perspective

Among the major influences on the entire educational system, and certainly career and technical education, are the economic developments that continue to have a significant impact on the professions, jobs, and ways of living and working of most people in most places in most parts of the world. Advances in technology, growing international economic competition, widespread use of the Internet, and the systems, operations, and style of management changes in most American businesses and industries have increased the demand for highly skilled and educated workers in this nation.

It is no longer a postagricultural or postindustrial world. Rather, it is a *new* world of fast communications, rapid decision making, and intelligent social skills that are needed to deal with economic, technical, ecological, and ethical issues facing virtually every economic, social, or political system (Nijhof 1998). This new economic world is vastly different from the agricultural/factory environment that ushered in public school vocational education at the turn of the 20th century. It is characterized today by international activity, cyberspace, ever-changing market demands and standards, shorter product life cycles, increasingly sophisticated computers, and the need for a more thorough knowledge of the whole business environment rather than just specific skills or narrow job tasks (Carnevale 1991; O'Hara-Devereaux and Johansen 1994; Wirth 1992).

Workplaces during the past decade have also ushered in new challenges. Today's workplaces are often in multiple locations characterized by cultural diversity, fragmented or "different" organizations and infrastructures, economic restructuring, and constantly changing worker roles and duties. Increasingly, economists and scholars talk about the ascendancy of knowledge as a primary product and competitive edge for many businesses; increased reliance on team problem solving—often from remote locations; an urgent (and sometimes difficult) need to manage information and technology; ability to analyze, synthesize, and evaluate information and use it to solve problems; new versions and forms of prerequisite technical skills; flexible jobs; and new iterations of related education and skill requirements, that is, a constant need to continue to learn and upgrade (Bernhardt, Morris, Handcock, and Scott 1998; Brown 1999; Carnevale 1991; Marshall and Tucker 1992; Wirth 1992).

In addition, the specific skills needed to enter and succeed in these workplaces have also changed significantly in the past 2 decades. Technical and technological skills remain important, but they must be modified and grounded in employees' ability to think of them in the context of the big picture (i.e., technical skills' role in knowledge and understanding of all aspects of the industry). But employers increasingly discuss the importance of new categories of skills crucial to employees' ability to work "smarter, not harder." These skills go by any number of labels: soft skills, generic skills, employability skills, new basic skills, essential skills, or applied general education skills. Any number of studies have identified them and the listing should be familiar to career and technical educators: knowing how to learn, interpersonal skills, competence in applying general education (reading, writing, calculating, computing) to workplaces, ability to work in teams or groups, effective listening and oral communications skills, adaptability and

flexibility, personal management skills with good self-esteem and personal and work ethics, leadership or initiative, and—seemingly, above all—the ability to think and to solve problems in workplaces. Many of these skills were once reserved for those in management; today, they are considered necessary for individuals at all levels of employment (Alpern 1997; Clagett 1997; Evers, Rush, and Berdrow 1998; Secretary's Commission on Achieving Necessary Skills [SCANS] 1991; Stasz, Ramsey, and Eden 1995).

In the United States today, fewer than 20 percent of the work force are in jobs classified as unskilled. This is almost an exact reversal of the nature of the American work force just 40 years ago. In 1959, 60 percent of the work force was unskilled, with 20 percent classified as professional and 20 percent as skilled. Today, 60 percent of the workforce is in skilled occupations and 20 percent in professions (Murnane and Levy 1996; ***21st Century Skills for 21st Century Jobs*** 1999); nearly all of these workers are required to have postsecondary education.

The jobs today are also different. The assembly-line, single-skill jobs of the factory or construction site and the office clerk-typist or bookkeeper are largely defunct. Rather, there is a tremendous demand for educated people with general employability and specialized technical skills in areas related to computer science and computer technology, high-tech manufacturing, software development, biotechnology, biomedical applications, sales and services, database management, and health care. The 10 fastest-growing jobs include database administrators and computer support, computer engineers, systems analysts, personal care aides, physical therapy assistants, home health aides, medical assistants, desktop publishing specialists, physical therapists, and occupational therapy assistants. Eight of these 10 jobs require postsecondary or extensive continuing education; the three fastest-growing positions generally demand college degrees (***21st Century Skills for 21st Century Jobs*** 1999, p. 5). Other rapidly growing or "hot" jobs, all of which require technical skills and (probably) postsecondary education include physician assistants, drafters, paralegals, emergency medical technicians, construction managers, dental hygienists, computer programmers, licensed practical nurses, machinists and tool programmers, and dieticians and nutritionists ("10 Hot Jobs" 1999, pp. 26-27).

These high-skill, high-tech jobs in the new economy virtually mandate that schools (and, incidentally, colleges) make significant changes in what and how teachers teach and to whom they teach it. In many prestigious reports and in interviews conducted for this report, businesses and business coalitions bemoaned the growing gap between the technical and social requirements of the workplace and the skills and education of people looking for employment.

Those in human resources especially described the limited skills brought to the hiring arena by applicants in today's labor pools. In citing a new survey by the American Management Association (AMA), Grimsley (1999) of the ***Washington Post*** reported that more than one-third of job applicants nationwide lack the basic math and reading skills for jobs they are seeking. This is an increase from 19 percent just 3 years ago. The biggest literacy gap was reported by executives in wholesale and retail industries who said that 56 percent of the applicants failed to meet basic math and reading standards; 43 percent of applicants for manufacturing positions had skill deficiencies.

There are several reasons postulated by employment officials interviewed for this report and by AMA's survey of personnel executives from 1,054 companies that employ more than one-fourth of the U.S. work force and had tested 165,684 applicants in 1998: a tightening labor market, narrowing applicant pools among high school graduates, "older" workers who are less apt to have higher levels of literacy skills, and some language barriers among immigrants. But the *major* reason seems to be a disconnection between applicants' education and the higher skills needed in today's workplaces where the new technologies and systems have raised the bar for job applicants in terms of literacy, math, and communication skills.

Many executives blame what they describe as weak school systems. Their criticism seems especially targeted to current students and recent high school graduates. In a 1997 press release, the presidents of the National Academy of Sciences, National Academy of Engineering, and the Institute on Medicine commented, "Many corporations report that only about one-tenth of American high school graduates seeking employment have the skills necessary to qualify for entry-level jobs" ("Preparing Workers for the 21st Century" 1997). Workers, too, give the nation's high schools poor marks in preparing high school students for work. In a study conducted in May 1999 at Rutgers University, more than 50 percent of America's workers gave high schools a C or lower on their effectiveness at preparing the next generation of workers (Joyner 2000, p. E3). So whether it is described as a one-third, a 25 percent, a 50 percent, a 56 percent, or a 90 percent failure rate of high school graduates to "pass" entry-level employment screening, a very serious problem exists for public education when significant numbers of business persons and groups perceive that schools are *not* teaching and students are *not* receiving the education they need to be successful in workplaces. Every economy has education baselines that must be met by all participants, and the perception seems to be that far too many U.S. high school graduates are below this baseline.

Groups representing business interests continue to ask the schools to provide a *better* education with more rigor and relevance to students and then instill the need for lifelong learning in both youth and adults. This increased education and achievement are thought to benefit businesses and industries in reduced training costs, reduced recruiting and hiring costs, positive employee responsiveness to innovation and changes, improved productivity, and in workers' ability to learn new skills, work multiple tasks and operations, and communicate with customers. In various reports and interviews, it was increasingly pointed out that small and medium-sized businesses especially need beginning employees with solid education and technical skills. Many smaller businesses are simply unable financially to invest in remedial general education and extensive employee training.

Growing out of the *new* economy and the related need for higher levels of education by businesses, efforts have increased considerably to strengthen the links between school and work for high school youth. Recently, 12 national business organizations—including the National Alliance of Business and the National Association of Manufacturers—joined forces to form the Business Coalition for Education Reform (BCER), a unique collaborative dedicated to strengthening the nation's schools <http://www.bcer.org/>. The BCER has pledged to support and expand business involvement in education at

national, state, and local levels. The primary goal for the BCER is to increase academic achievement for all students. The collective voice emphasizes strongly more time and focus by all students on the core curriculum and admonishes schools to stop tracking students out of the core curriculum. The BCER coalition also pledges to ensure that academic standards reflect the skills needed for personal and career success in a changing economy and to help the public understand the critical need for world-class academic standards and the changes school systems must make to achieve them. The BCER leverages resources, expertise, and partnerships to help states and communities learn from each other's experiences in advancing education reform.

The American Business and Education Partnership <http://www.acteonline.org/abepmenu.html> consists of more than 100 business and education leaders who are dedicated to transforming the nation's educational system to ensure that its graduates possess both academic and technical skills required for today's and tomorrow's job market. Sponsored by the Association for Career and Technical Education, this business partnership aligns with its tagline, "Rethinking the Way America Does Business with Education."

A third principal player trying to influence educators to be more responsive to workplaces is the National Research Council (NRC), which has synthesized, summarized, and highlighted reports to inform education discussions in a number of key policy matters. NRC and its major affiliates (the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine) have focused especially on developing national standards for math, science, and technology, as well as influencing instructional practices, assessment, and achievement for *all* students (National Research Council 1997).

From Students' Perspective

It is also important to recognize in any redirection of high school career and technical education the role the new economy is playing in determining the need for all students today to have increasingly higher levels of academics and to know more and to be able to learn even more. It is simply in the best interests of all high school students to plan for and prepare to attend postsecondary education whether they want to or not. This crucial information should be included in career development and guidance sessions for all students in all schools.

In his summit on 21st Century Skills for 21st Century Jobs <http://www.wpskillsummit.org>, Vice President Gore highlighted an administration report showing that increased education and training are linked to higher employee wages and employer productivity, with college graduates earning an average 77 percent more than individuals with only a high school degree (up from previous reports showing comparable figures of about 58 percent). Other reports and studies have also highlighted the salary differential among various levels of education.

In all studies, higher levels of learning result in increased wages. For individuals *not* earning a high school diploma, the long-term financial outlook is not good. Expressed in

constant 1997 dollars, the average high school dropout earned 42 percent less annually than the average person did with a high school education—$16,124 compared to $22,895. An associate's degree adds $3,340 ($26,235) and a baccalaureate degree adds $17,583 ($40,478) to the average high school graduate's annual salary. An advanced degree adds $40,334 ($63,229). Stated differently, for full-time workers aged 25 or older, less than a high school diploma means $342 per week on average, a high school diploma (no college) means $481 per week, and college graduation means $842 per week. Some college also increases the median annual earnings of full-time, year-round wage and salary workers for all adult population segments. For example, just 1 year of nondegree education at a college increases hourly wages above those for high school graduates by 8 percent for males and 5 percent for females under 21 years of age (Bureau of Labor Statistics 1998; Choy 1998; Decker 1996; Medrich 1996; Phillippe and Patton 2000; Toth 1999; ***21st Century Skills*** 1999).

In addition to higher salaries and wages, various government data also show that increased levels of educational attainment and academic achievement enhance students' future abilities to earn a good living and sustain a career in other ways. They correlate strongly with improved worker productivity, less unemployment, greater benefits, ability to learn new skills and workplace operations more rapidly, exposure to and engagement with computers, and generally, better ability to negotiate the rigors of the labor market. Even dislocated workers with an associate's degree or higher find new jobs at higher average pay than the jobs they lost (***21st Century Skills*** 1999). Conversely, the Bureau of Labor Statistics (1998) reported that the unemployment rate for out-of-school youth (16-24 years of age) who have not graduated from high school is 19.8 percent, compared with 11.1 percent for those with a high school diploma (no college) and 2.1 percent for those with a baccalaureate degree.

The conclusion is indeed obvious. Drawing on economic analyses of wage and salary and other employment-related data and information, individuals' investment in education and further training pays big dividends—the more education, the better.

Public Expectations

An examination of public surveys leads to two conclusions about public expectations related to career and technical education: (1) the public does indeed want career education and work skills included as critical components of the public school K-12 curriculum, and (2) parents expect their children to attend college.

In a recent nationwide survey conducted by the Gallup Organization with funding from the Office of Educational Research and Improvement, Marzano, Kendall, and Cicchinelli (1998) concluded that five subject areas have the requisite level of support (i.e., majority acceptance by the American adult public) as *definitely necessary* in school curriculum: health, **work skills**, language arts, technology, and mathematics. The survey asked the respondents to evaluate each of 248 standards as one that students should *definitely, probably, probably not*, or *definitely not* know or be able to do by the time they graduate from high school. The standards were later classified into 15 subjects for purposes of analysis.

Within each of the 15 subject areas, the specific standards may have been ranked differently; that is, there was considerable variability within subject areas relative to the perceived importance of specific standards. But in the Work Skills subject, the majority of respondents rated all standards as *definitely* necessary. The standards for Work Skills, written by "experts," seem heavily drawn from the "soft" or "employability" skills discussed earlier as well as general life skills. They include, for example, standards about working with others, working with tools and technology, self-regulation, work ethic, and managing money.

Another objective of this Gallup survey (Marzano et al. 1998) related to the overall goals of education. Question 1 stated: "A main goal of education should be to provide knowledge that helps individual students obtain meaningful employment." About 79 percent responded *definitely*, more than 18 percent said *probably*, and fewer then 3 percent said *probably not* or *definitely not*. This current survey data of public opinion adds additional support to many studies conducted by Gallup and others during the past century that have supported the public school's role in preparing youth for employment and careers.

Americans increasingly recognize the value of education and expect their youth to attend college. When surveyed, nearly all graduates of the class of 1992 said they planned to attend postsecondary education either right after high school (77 percent) or at some later point (an additional 20 percent); 71 percent of them say they planned to earn a bachelor's degree. Even among completers whose families had low incomes or whose parents' formal education stopped at high school, the vast majority (94 percent in each case) planned to continue their education at some time (Choy 1998). In a recent study by ACT, 77 percent of 1999's 10th graders indicated that they planned to attend a 4-year institution after graduation. Of the 634,700 students surveyed, only 6 percent planned to attend a community or technical college and another 3 percent saw vocational or proprietary school, job training through the military, or career apprenticeship in their future (***Vocational Training News***, June 29, 2000).

In reality, however, actual college attendance compared with "wannabe" college attendance is far from a perfect correlation. About 67 percent of 1997 high school completers enrolled in college in October of that year; nearly two-thirds of them enrolled at a 4-year college and about one-third enrolled at a 2-year institution. Women attended in larger numbers and proportion then men; 70.3 percent compared with 63.5 percent. About 20 percent of those new college attendees were enrolled part time (Bureau of Labor Statistics 1998). More comprehensive, segmented data appear with the graduating class of 1992. The following is a summary from various government data sets about the postsecondary attendance of this class:

1. 73 percent of 1992 graduates were enrolled in a postsecondary institution within 2 years of graduation (Levesque et al. 2000, p. 110).
2. Of the 1992 graduates enrolled in college 2 years later, 93.2 percent were from the college preparatory curriculum, 48.8 percent were from a vocational education concentration, 90.6 percent completed both a vocational concentration and the college preparatory curriculum, and 69.1 percent were from "other or general" (ibid., p. 111).

3. The previous figures are a marked increase in college enrollment rates from a decade earlier, when 57.3 percent of 1982 public high school graduates enrolled in a postsecondary institution within 2 years of graduation, about 41.5 percent had been vocational concentrators, 86 percent had completed both a vocational concentration and the college preparatory curriculum (very small number), and 61.2 percent had graduated with an other/general classification (ibid., p. 110).
4. Among 1992 public high school graduates who enrolled in postsecondary education within 2 years of graduation, vocational concentrators (58.4 percent) were much more likely to enroll in public community colleges than were college preparatory graduates (18.7 percent). An additional 13.5 percent of vocational concentrators went to private 2-year or nondegree technical schools; only about 2 percent from the college prep curriculum did likewise (ibid., p. 111)
5. Nearly 80 percent of the graduates of the 1992 college preparatory curriculum attended a 4-year college (52.3 percent public and 26.4 percent private not for profit); conversely, 39 percent of vocational concentrators did so (30.5 percent at a public 4-year and 8.5 percent at a private not-for-profit college) (ibid., p. 111).
6. Nearly three-fourths (74.5 percent) of the graduates from both the college preparatory and vocational concentration curriculum attended either public (58.8 percent) or private not-for-profit (15.7 percent) 4-year colleges (ibid., p. 113).
7. The public 4-year enrollment rates of high school graduates who completed both a vocational concentration and a college preparatory curriculum were similar to high school graduates who complete a college preparatory curriculum only. They are much higher than students who completed a vocational concentration only (Hudson and Hurst 1999; Levesque et al. 2000).

It is interesting to note that most students work while attending college. In an October 1997 survey (Bureau of Labor Statistics 1998), 57.3 percent of college students were employed. Nearly 70 percent of 2-year college enrollees worked and nearly 53 percent of those enrolled in 4-year colleges were employed; 88 percent of part-time students and 51.6 percent of full-time students were working. Even freshmen worked; 37.1 percent of them attending 4-year colleges and 63.2 percent of those attending 2-year colleges were working in October. It is assumed that many of the working students benefited from some high school career and technical education to provide them with appropriate work skills that qualified them for employment. Related surveys show that parents generally want their children to attend college, expect them to work to pay for some of the expense, and expect the public schools to provide them with the work skills to do so.

Despite the positive enrollment of high school graduates in higher education, studies indicate that the United States has a dismal record for college program completion or graduation. There is clear evidence from the government's ***Condition of Education*** report (Wirt et al. 1998) that at least 28.3 percent of U.S. college students drop out before completing a bachelor's or associate degree or certification program and that another 17.5 percent indicate they are still enrolled 6 years after initially entering college. According to recent studies by ACT, nearly 26 percent of all 1999 freshmen in 4-year colleges and 44.9 percent of freshmen at 2-year colleges did not return for a second year. Further, ACT claims that only about 51 percent of all college students will

complete a baccalaureate degree (***Vocational Training News***, June 29, 2000). The Organization for Economic Cooperation and Development claimed the United States ranked 23rd of 31 countries worldwide on high school and college graduation rates, with 37 percent of U.S. undergraduates dropping out before competing a baccalaureate degree ("United States Ranks 23rd" 1999). Studies and statistics do vary on the exact percentages. Some report only data from public, state-supported institutions; others include private schools as well. But the 50 percent figure is probably reasonably accurate; that is, only about 50 percent of students who start college or university—and certainly those who attend state-supported systems—will eventually receive a baccalaureate degree (Kirst 1998).

In reviewing extensive data and conducting interviews with scholars and data analysts for this report, three conclusions seem obvious: (1) the public expects high school youth to attend college and indeed more continue to do so each year; (2) huge numbers of high school graduates are not prepared to be successful at 4-year colleges, and large percentages (50 percent probably on a nationwide average) will drop out before completing a liberal arts baccalaureate degree or a professional program within 6 years; and (3) almost all high school students could and should benefit from career and technical education.

Perhaps less obvious, a conclusion that seems to make sense is that economic and public expectations are that virtually *all* American youth should complete a solid, high-quality education that includes career and technical education through the equivalent of 2 years of postsecondary education.

Student Learning, Motivation, and Achievement

> We've probably learned more about the mind and how it works in the last, say, 25 years than has been learned in all previous systematic study. But to translate that kind of knowledge into different kinds of classroom practices and different kinds of attitudes about the mind is not an easy process. ("Interview: Howard W. Gardner" 1995)

A third factor that contributes to thinking about new directions for career and technical education as we advance into the 21st century is recent research and increased wisdom about how students learn and can be taught to learn even more in schools and other environments. This is important knowledge as we continue to figure out how to motivate more students to stay in school longer, to draw from their interests and personal experiences to advance their learning, and to show them connections between that which must be learned and how it is used in the world.

It is a fundamental assumption at the outset of this section that nearly all students can be motivated—and thus taught—to learn and to learn at increasingly higher levels in all subjects including career and technical education. And it is the school's responsibility—working in tandem with parents and relevant community groups—to figure out how to motivate and teach them effectively.

In addition, career and technical educators cannot abdicate their responsibility to help their students learn deeper, critical, and theoretical knowledge that has to underpin job skills and tasks they are teaching to students. They must help students learn and plan for the long term and not just be content with relatively short-term job training. Some vocational educators may still be hiding behind the historical rhetoric, using only a competency-based, job task framework in designing curriculum and instruction. Learning or acquiring *x* number of job skills in a high school vocational education program is simply no longer sufficient to develop the long-term employment opportunities for youth.

Relatively recent theories and research on cognition and learning do clearly support some of the instructional approaches historically used by vocational educators—learning by doing, head and hands, theory and practice—and will continue to be used by career and technical educators in the 21st century. Many of the applied, practical, hands-on instructional approaches used by vocational education teachers historically have much to offer to colleagues who teach academic subjects in high schools. Much of this instruction has helped to shape new theories and research from the cognitive sciences. Workplaces especially can provide real-world contexts for cognitive development.

We simply know today so much more than we knew 25 years ago about how individuals learn, think, remember, perceive, form associations, transfer knowledge, construct knowledge and meaning from new information, and apply knowledge to solve problems including those that are poorly structured and unfamiliar. We also know more today about how to structure curriculum and learning experiences for young people that build on our new knowledge of cognition. Further, we know more about how to motivate more students to continue to learn more. Our challenge, of course, is to figure out how to use this new knowledge to advance student achievement in schools and other learning environments (e.g., workplaces).

Business persons and educators involved with this report say we must help *all* students to reach new levels of higher-order thinking. This, then, is much of the impetus that undergirds the initiatives to integrate vocational and academic education: Higher-order thinking skills—grounded in recent research about cognition—are essential and must be taught. It is important to teach youth how to think, not just what to think. Any definition of higher-order critical thinking skills includes the ability to think creatively, make decisions, solve problems, visualize a solution, reason, analyze, interpret, and continue to learn. Critical thinkers draw on a variety of resources and disciplines to solve problems, they use standards of performance as a benchmark, and they are intermittently independent and group reliant for assistance.

We are also beginning to learn more about adolescent and adult learning, retention, and application processes in nonschool environments. There are implications to be drawn from how learning occurs and knowledge is developed in organizations such as businesses, nonprofit agencies, and government that offer apprenticeship and other forms of work-based learning programs. A major finding, for example, from the learning organization literature is that the essence of real learning—that which leads to individual and

organizational changes—is social (i.e., undertaken with peers) and tackles real problems (Spence 1998).

At all levels of society—national, state, local—our desire to increase achievement for all students may hinge on our willingness to implement meaningful changes in our school systems and in instruction based on knowledge and research about how students learn and acquire knowledge. This is tough work. The research and its implications are not consistent with most people's historical experiences of schooling nor with their perceptions of how they think students learn and should be taught. Like it or not, many people do perceive intelligence and ability to learn as defined by the intelligence quotient (IQ), which assumes that a person's intellectual potential is fixed, genetically determined, can be measured early in life, and largely determines an individual's potential to learn.

Thus, much of the public's fundamental philosophy or beliefs about schooling, how students learn, how schools should operate, and the entire assessment process is probably at odds with much of the research related to learning. This perception of learning grounded in IQ scores (a one-time "dipstick" measurement) along with the disconnection between knowledge about learning and much of current practice in school seems especially prominent among those who control the power and the purse strings in education.

Throughout most of the educational history of the United States, education has essentially operated under the assumption that cognition is mostly enhanced through memorization of facts and formulas and acquisition of pieces of knowledge and bits of skill by reading chapters, outlining the content or answering factual questions at the end of a chapter, and taking notes from the teacher's lectures about the content. Drill, drill, and more drill was—and still is—the prevailing teaching method in many classes at all levels of education throughout the United States. Most of education is passive or, at best, responding to that which the authoritative teachers or textbooks say. Much of education—certainly at the high school and collegiate levels—still functions that way today. As wryly noted by Howey (1998), "Sadly, the primary learning tool for too many students is a yellow highlighter" (p. 295).

In more traditional or classically structured classrooms, student assessment is typically based on objective tests of content prepared from the textbook and the teacher's lectures. The classroom environment is competitive (who can get the highest score on the test), independent (i.e., one student listening or reading or working quietly at a self-contained desk with minimal interruption by classmates), and controlled (teacher talks, students listen).

Summarizing a decade of research on cognition, Berryman and Bailey (1992) emphasized two major points. First, school "routinely and profoundly violates" all that we know about how students learn and the proper conditions under which they should apply knowledge appropriately to new situations. Second, these practices permeate all levels of American education. The authors exploded five myths about learning that they say are prevalent in American education practices:

1. The educational establishment assumes that people predictably transfer learning to new situations. (They don't.)
2. Learners are best seen as passive vessels into which knowledge is poured. (They aren't; students learn best through active processes.)
3. Learning is the strengthening of bonds between stimuli and correct responses (behaviorist theory of learning), which means breaking learning down into single subjects, simpler subtasks, routines, and items (based on Taylor's scientific management of workplaces, which is no longer practiced in most businesses).
4. What matters is getting the right answer. (Wrong; accepting only correct answers tends to negate development of skills associated with problem solving, discovery, and deeper understanding of concepts.)
5. To ensure their transfer to new situations, skills and knowledge should be acquired independently of their contexts or use. (Dead wrong.)

This is critical information for career and technical educators, as well, and it is important to debate as we reform programs, curriculum, and teaching methods in the next decade. Our historical grounding (aka philosophy) in teaching and learning has been most closely identified with Charles Prosser's essentialist philosophy of education. Prosser, the original director of the Federal Board for Vocational Education after the passage of the Smith-Hughes Act in 1917, believed that a practical education must be provided to prepare large numbers of students in a trade or vocation. He espoused specific training in schools for jobs needed in production and manufacturing industries.

The premise behind Prosser's essentialism is that education should train for specific jobs rather than train for culture: "Vocational education only functions in proportion as it will enable an individual actually to do a job…Vocational education must establish habits: habits of correct thinking and of correct doing. Hence its fundamental theory must be that of habit psychology" (Prosser and Quigley 1950, pp. 215-216). Prosser then prepared and justified 16 theories (better called theorems) around this essentialist philosophy to guide vocational education. Many of the theorems were carefully written to distinguish and separate vocational education from general or academic education and to teach until "right habits of doing and thinking are repeated to the point that the habits developed are those of the finished skills necessary for gainful employment" (p. 222). Again, it is important to understand this founding philosophy of vocational education and the related theorems. They are still very prevalent in many segments of the profession and are often used as the rationale for continuing specialized job training at the high school level.

The essentialist philosophy helped to shape behaviorism, which believes that stimuli (e.g., reward and punishment) help develop desirable responses and behavior—and thus learning—in the learner. Thus, for vocational education purposes, it was believed that we learn from business and industry the competencies that are needed (knowledge, skills, behavior) and, using prospective employment as a stimulus, teach these competencies to our students. It was further thought that there was the right way—the "correct" way—to learn these skills and at a level of acceptable performance. Behaviorism was and is the foundational theory for today's competency-based vocational education programs.

As discussed in this section and elsewhere, the new economy clearly calls for more inclusion of *thinking* and *culture* into career and technical education. The learner needs to be able to make sense of the workplace and its context within that person's life. It isn't just "training" for specific jobs, but "education" to make decisions, solve problems, find answers, and draw on a variety of disciplines and cultural contexts to make sense out of changes, challenges, and day-to-day operations at the workplace. Thus, the learner (i.e., the worker) needs both the theory or the broad framework of that which underlies the mission and all aspects of that industry as well as the company's and his or her role, responsibilities, and duties within the larger society. This leads to the integration of vocational and academic education, which may be among the most important recommendations emanating from Congress in the past three Perkins Acts.

Much of educational psychology and research in the last 20 years tends to support instructional approaches associated with active, contextual learning. That is, students are apt to understand more, retain more, and apply more if the knowledge is taught in active, engaging environments, in context, and students are allowed to put the knowledge to practice by demonstrating its application in some way. The various research studies have been grounded in several theories:

- The situated nature of cognition, which sees knowledge as inseparable from the contexts and activities within which it develops
- Constructivism, which views the learner as one who constructs meaning from that which is learned through active, individual, and personal processes based on previously constructed knowledge
- Social and cultural factors, which determine what, how, and how much we know and learn
- Cognition that is distributed over the individual, other persons, and various artifacts such as physical and symbolic tools
- Achievement and motivation, which are directly related to students' ability to make sense out of that which they are to learn

New theories of multiple intelligence embrace the knowledge that different students do learn differently and draw on research on the way the brain processes information. Howard Gardner (1983), Professor of Education at Harvard University, is the nation's most renowned scholar on the theory of multiple intelligences. Gardner has identified eight distinct forms of intelligence: verbal-linguistic, logical-mathematical, visual-spatial, kinesthetic, musical-rhythmic, interpersonal, intrapersonal, and naturalistic. Gardner believes that people do possess all eight intelligences, but in varying degrees of strength and skill. One key to effective teaching and thus enhanced student achievement, according to Gardner, is for teachers to structure lessons and experiences that draw on each student's primary learning style(s).

Flannery (1993), drawing on the adult and continuing education literature, categorizes learning styles as analytical (field independent-FI) or global (field dependent-FD). Analytic or FI learners ("left brain") process information sequentially, use logical inductive processes, and perceive information in an abstract, objective manner. Global ("right-brain") learning processes are deductive, intuitive, concrete, and subjective. Global or FD individuals use their entire surroundings—including other people—to process information. These are two very different ways of learning and it is difficult, for example, for "right brainers" to process complex material—especially in math and science—that is taught through very traditional, deductive learning processes.

Others categorize learning styles in other ways. James and Gardner (1995) describe three categories: perceptual, cognitive, and affective. Griggs (1991) uses personality models, information processing models, social interaction models, and instructional preference models. These theorists draw heavily on the personality and social styles of learners as important clues as to how best to teach them. Regardless of the specific categories, the point is that individual and cultural group learning styles differ. Finding ways to address these differences is a challenge and responsibility for all involved with education.

Contemporary researchers are synthesizing much of the research from the last 20 years on student cognition and learning into a relatively new theory of contextual teaching and learning. These researchers have concluded that cognition involves much more complex activities than once thought. Cognition today is said to be (Borko and Putnam 1998)—

- *Situated* in particular physical and social contexts; how a person learns a particular set of knowledge and skills and the situation in which he or she learns them is a fundamental part of what is learned and closely connected to a person's ability to transfer the knowledge.

- *Social* in that interactions with people in one's environment are major determinants of both what is learned and how learning takes place; an important part of what it means to become competent in one's domain (math, science, workplaces, music) is to learn the forms of discourse and argument and other accepted ways of reasoning, acting, valuing, and performing within that discipline and with one's colleagues and teachers.

- *Distributed* or "stretched over" the individual, other persons, and symbolic and physical environments.

This work on contextual teaching and learning gives additional credence to the policy-influencing initiatives to integrate academic and vocational education and, indeed, to bring more of the pedagogy historically identified with career and technical education to academic subjects. A few groups developing national standards for specific subject areas, such as the National Council of Teachers of Mathematics and the American Association for the Advancement of Science, have included workplace problem solving in the standards themselves. Concomitantly, it is incumbent upon career and technical

educators to include more of the theory underlying knowledge and skills they teach relative to particular industries and careers.

A recent initiative of the U.S. Department of Education's Office of Vocational and Adult Education (OVAE) has sought to provide further analysis of contextual teaching and learning and its implications for the preservice and continuing education of teachers. In summarizing the compendium of papers commissioned by OVAE, Howey (1998) operationally defined contextual teaching and learning (CT&L) as follows:

> Contextual teaching...enables learning in which students employ their academic understandings and abilities in a variety of in- and out-of-school contexts to solve simulated or real-world problems, both alone and with others. Activities in which teachers use contextual teaching strategies help students make connections with their roles and responsibilities as family members, citizens, students, and workers. Learning through and in these kinds of activities is commonly characterized as problem based, self-regulated, occurring in a variety of contexts including the community and work sites, involving teams or learning groups, and responsive to a host of diverse learners needs and interests. Further contextual teaching and learning emphasize higher-level thinking, knowledge transfer, and the collection, analysis, and synthesis of information from multiple sources and viewpoints. CT&L includes authentic assessment, which is derived from multiple sources, ongoing, and blended with instruction. (pp. 19-20)

Howey's view of CT&L embraces other theories and terms used by learning theorists—experiential learning, real-world learning, active learning, learner-centered instruction, and action learning. Thus, it is important to state that this extensive definition is indeed meant to embrace much of existing practices by many teachers. In some respects, CT&L supports and amplifies what many effective teachers have always done. But it is just as important to state that far too many teachers continue to use very traditional, talk-and-chalk methods.

In summary, the exploding knowledge about brain development, cognition, and learning theory and their relationship to student motivation and achievement continues to seriously challenge the way in which the vast majority of students have been and continue to be taught in public schools today. The majority of students simply do not learn as well or retain as much knowledge and information through such primary teaching methods as lecturing, lecturing with overhead or chalkboard (or even an LCD panel), and quiet time working or reading at one's desk. This, of course, works for some youngsters and may prepare some of them to be successful with the typical state and local standardized tests of recall, facts, formulas, terms, definitions, sequences, dates, and short answers to objective questions—all of which have an absolute "correct" answer.

For most high school students, not only are these traditional methods boring (and therefore school is boring), but they don't learn well and are unable to recall or apply much of the material months or even days later. Conversely, studies consistently show that students who are actively engaged in their learning, apply the content in context, draw on

prior knowledge to construct and synthesize new knowledge, and are allowed to demonstrate knowledge acquisition in a variety of ways do, indeed, retain the knowledge and its practices far into the future. Unfortunately, most active learning processes do not make for quiet, well-ordered classrooms; easily constructed and graded "standard" examinations; and one clear winner (i.e., head of the class or valedictorian).

Yes, it will be tough to change the learning culture in schools to more active, student-engaged environments, with some of the knowledge acquisition being delivered in places other than school classrooms. Career and technical teachers have much to offer in this arena of teaching and learning. They have long engaged in active, action-oriented learning environments (e.g., typing, auto tech, agricultural education with its supervised farm projects, and cooperative education programs). Conversely, career and technical educators must pay increased attention to the theory and the essence of the why (not just the how) in planning programs, curriculum, and instruction. It is the blending of the academic with the vocational that is probably the most responsive to the knowledge of how high school students learn and remember best.

School Reform

> Schools and school systems in the United States have done a noteworthy job of preparing students for the industrial age; fewer have systematically decided how they will prepare students for the 21st century. Therefore, if we continue on our present path, we'll be preparing students for a world that will no longer exist. (American Association of School Administrators 1999, p. 6)

In addition to the new economy, increased public expectations that more high school graduates will attend college, and research on student learning, a fourth late 20th-century development that affects important reforms in career and technical education is the rather loud call for school reform. Nearly every individual or group interviewed for this report—whether from business, professional or trade association, government, or education—commented that it is insufficient to reform only vocational education into a new career and technical education without major changes in public schools, especially high schools.

Poll after poll, thousands of pieces of education legislation from the 50 states, and cumulative analysis of writings of scores of educational journalists from the nation's top newsmagazines and newspapers all show that education today is the number 1 concern of the American public. The National Conference of State Legislators expected school quality to top state legislative agendas in 1999 (Toth 1999).

The quality of high school education seems to be the principal target for the reform efforts. There is no single statistic, survey, or anecdote that best depicts the public's discomfort with the quality of the high school experience. It probably began with the 1983 release of the report, ***A Nation at Risk***, with its eloquent prose denigrating the "rising tide of mediocrity" of American education and its call for significant reforms in education, especially in high schools (National Commission on Excellence in Education 1983). Thousands of pieces of state-level legislation were passed in the 1980s and

1990s, probably as a direct result of **A *Nation at Risk***. Most state legislation raised requirements for students that could be quantified, such as more high school credits, more credits in selected subjects (i.e., math and science) required of all students in order to graduate, and tougher standards in most subject areas. Today, for example, 48 states require students to be tested in academic subject areas and 36 states require state-determined passing scores before students can receive a high school diploma. Some of these exams or exit standards are considered fairly mediocre by curriculum content experts; others—especially some of those most recently developed—are considered quite tough, and there is genuine concern that huge numbers of students are not being adequately prepared to pass them.

A recent wake-up call that stirred up legislators and many educators came from the results of U.S. students' scores on international tests of math and science. The Third International Mathematics and Science Study (TIMSS) is the largest ever undertaken and includes data from one-half million students in 41 nations. U.S. schoolchildren are the only students internationally with above-average scores in 4th grade to lose ground in the 8th grade, and then do worse again in the 12th grade. In the fourth grade, U.S. students' achievement is near the top in both math and science. By the eighth grade, U.S. students are still above the international average in science, but below the international average in math. However, by the 12th grade, U.S. science and math performances are below the international average and among the lowest of the 21 TIMSS countries whose 12th graders completed both math and science examinations. In an analysis of the results, researchers concluded that U.S. math and science curricula lack the "coherence, focus, and rigor of the curricula taught in other countries that participated in TIMSS" (National Institute on Educational Governance, Finance, Policymaking, and Management 1999, p. 1). Other reasons cited for the low U.S. scores were the emphasis on acquisition of skills rather than problem solving and thinking, failure to include deductive reasoning, repetitive and unchallenging curriculum and textbooks in grade after grade—"a mile wide and an inch deep" (Hettinger 1999, p. 31), and, in general, lower-quality lessons by U.S. teachers.

But it isn't just low test scores on international examinations or even failure to meet state-determined standards that have the public buzzing about American high schools. Other reports and anecdotes cite the increased violence in schools and alienation among increasingly large numbers of high school youth, especially their estrangement from parents, other adult mentors and guides, and institutions—including schools themselves—that were once thought to provide structure and support for youth. The schools simply may be too isolated from communities. Many cite the lack of career direction and planning by so many students as problematic in high schools. Huge percentages of students, probably as many as 42 percent, "wander around the curriculum" by selecting courses at random without regard to any particular focus or plan. They are neither in the college prep nor the vocational curriculum (Hudson and Hurst 1999). Students seem to be delaying any career preparation until college without a clue as to what to study when they get there. This may result in so many who leave college before completing; they still can't find the connection between school, work, and other elements from the real world.

A View

Conversations about the American high school and its students seemed to elicit some of the most negative reaction from the individuals and groups interviewed for this report. Various groups (and some of the written reports) commented with terms and phrases such as "intellectual wasteland," a place to "sort and separate" students, a place where students are in the college-bound track and there's not much for anyone else, filled with departments that model themselves after colleges with very specific subjects and turfs and with little regard for real learning, unresponsive to the needs of the community or businesses, curricula and standards that are dictated by colleges, "huge warehouses," "cavernous, soulless places," "too focused on control and too little on learning," "the rich get it all and the poor get the scraps," provides a "bleak future" for those not headed to college, and "places that should be sued for alienation of affection."

Conversely—and this is important—most all spoke of their fondness for teenagers, the desire to see *all* teens have a fair shot at a good education and a good life, and the willingness to invest time and money to reinvigorate American high schools. Thus, several recent reports have addressed specifically the reform of the American high school. As a basis for the reform agenda, many staff and researchers of business coalitions, professional education associations, and the U.S. Department of Education have studied effective high schools, visited countless schools throughout the country in an attempt to determine success factors, and reviewed the literature.

Effective public high schools seem to have a clear vision and mission that integrate well the dual goals of providing (1) *individuals* (their students) with a solid education to enhance their personal income, continued learning opportunities, and responsibility in a democratic society and (2) *communities* with educated citizens and a work force to enhance a competitive and productive society and a higher standard of living for all citizens. Thus, effective or even outstanding high schools seem to be highly responsive to the community and highly responsible to the students' individual development. Their leaders are visionary and consider the long-term effects of a solid education, use data appropriately for assessment and direction-setting purposes, and involve adults heavily in education processes. As further elaborated in the elements of effective schools, the work of the school and the work of the community—and its families—are integrated in policy, planning, and implementation.

Common denominators from several reports (American Association of School Administrators 1999; Bottoms, Presson, and Johnson 1992; National Association of Secondary School Principals 1996; Toth 1999; U.S. Department of Education 1998) that have evaluated and reported on "outstanding" or "effective" high schools include the following:

- High academic standards that encourage all students to take courses that put them on track to succeed. The best high schools set valid standards and high expectations that will help all graduates perform in the real world and not simply score well on standardized tests. The standards include those that relate to workplaces, communities, and technology. All standards are clear, challenging, and understood by stu dents, teachers, parents, and communities including, of course, businesses and industries.

- Coherent core curriculum that integrates rigorous academic content with real-world applications, enabling students to see relationships between content and future roles they may envision for themselves; curriculum includes those essentials that students must master to high standards to graduate from high school.

- Assessment of student progress, evolving from valid standards, that is authentic, performance based, used to support learning, and considers students' individual talents, abilities, and aspirations.

- Strategies to enhance student success, including tutoring, adult mentoring, coaching, help sessions, counseling, contemporary computer labs and tools and equipment, "second-chance" opportunities, some flexibility with time (e.g., extended block, day, year), evening classes, strong curriculum and career planning programs, and cocurricular activities. Simply stated: There are good human, equipment, and financial resources.

- Availability of school-supervised service- and work-based learning opportunities through internships, youth apprenticeship programs, cooperative education, simulations or integrated projects, and community-based activities.

- Highly qualified teachers—caring, knowledgeable, comfortable with constructivist approaches, who teach to high standards and help students achieve them, and adjust instruction to learning styles of students. This is *the* key to increased student achievement.

- Strong support for teachers—especially mentoring programs in their first 3 years of experience as well as research-driven professional development for more experienced teachers.

- Meaningful partnerships with parents, local colleges including community and technical colleges, business and industry, policymakers, social services and other community groups.

- A small-school or school-within-a-school environment where administrators and teachers know *each* student, often achieved with a team approach through an integrated professional, career, or applied major. All students are treated with respect and taught to be "good people." They have faculty advocates (advisors) who help personalize the educational experiences.

- Governance policies and administrative support systems and structures that enhance student and teacher success, draw on valid and reliable data and research, focus on student learning, encourage student attendance, broker professional development, provide safe and stimulating learning environments and physical facilities, and truly provide leadership.

There is also some evidence and certainly support from many community and some education leaders to open the high schools, and certainly the career and technical

facilities, "around the clock" for lifelong learning to enhance education and achievement for everyone in the community. Previous studies on school finance have also indicated that communities tend to support their schools in very positive ways (including support for increased funding proposals) when they feel they have access to school facilities during those times when students are not using them.

There really is not a lot of hard, statistical or other evaluative data to support most school reform programs, or at least those programs that have a national agenda or focus. This is especially true if the fundamental goal of the reform is increased student achievement as measured by standardized test scores. The denominators that are common across the various reform initiatives seem to make sense and many of their inherent components are reasonably well grounded in data. The initial review by experts who have designed, engaged in, or studied high school reform believe that all 10 of these common denominators or key elements of reform need to be included, to some extent, in the redesign or reform of the American high school.

Recently, the American Institutes for Research (AIR) under contract to the American Association of School Administrators, American Federation of Teachers, National Association of Elementary School Principals, National Association of Secondary School Principals, and National Education Association, published comparison data on 24 schoolwide reform initiatives. The 24 approaches reviewed were selected based on 5 criteria (AIR 1999, p. 7):

1. They are promoted by their developers as a means to improve student achievement in low-performing schools.
2. They are mentioned by name in the federal legislation that created the Comprehensive School Reform Demonstration Program and thus qualified to be considered for receiving federal funds to support their initiatives.
3. They are used in many schools and school districts.
4. They have obtained national visibility in the education and popular press.
5. There is some research evidence about their effects on students and/or their implementation in schools.

The primary factor AIR examined was the reform group's effectiveness at raising student achievement through such quantitative measures as test scores, grades, and graduation rates. Data and other evaluative measures had to be independently verifiable beyond the claims of the reform group and its developer(s). The research team also described the approaches used by each of the reform groups along a number of dimensions (e.g., years introduced in schools, number of schools, costs, etc.). AIR and the sponsoring organizations essentially wanted to know which reform initiatives now available for adoption worked, which just hold promise, and even perhaps which are dubious.

The review found that only a few of the reform groups have available much in the way of documented positive effects on student achievement through statistically valid and reliable measures. Several reform initiatives appear promising, but lack empirical research or may be just too new in their processes for a valid assessment of student

achievement and other outcomes. Some just never got around to collecting data or evaluating their work. Some are much more concerned with creating a more positive school atmosphere or happier students and teachers than they are with increasing student achievement. Some essentially surround reform processes around tough standards or a rigorous academic curriculum, but haven't assessed the results.

There are three notable exceptions, two of which are focused on elementary school children and one on high school youth. At the elementary level, *Success for All* is a comprehensive approach to restructuring schools, especially those serving students placed at risk in preK-6, directed by Dr. Robert Slavin in Baltimore. The main goal is to ensure success in reading, and at least 90 minutes of daily instruction are devoted to reading. *Direct Instruction* is a model growing from work on teacher-directed instruction begun by Siegfried Engelmann at the University of Illinois in the late 1960s and now continued at the University of Oregon. Direct Instruction serves students in K-6 in traditionally low performing schools in high-poverty areas; it focuses elementary school instruction on particular skills (initially on reading, language, and math) and shows students how to apply these skills in increasingly complex situations.

The third reform initiative with cumulative data showing increases in student achievement according to AIR's criteria is *High Schools That Work*, which is essentially a set of strategies designed to raise the academic achievement of career-bound high school students by combining the content of the college prep curriculum with career and technical education. High Schools That Work is administered by the Southern Regional Education Board (SREB) in Atlanta with Gene Bottoms as its director.

High Schools That Work deserves increased attention by career and technical educators and indeed by the education community as a whole. It does draw into focus much of the literature and research on school reform and targets it to students who are career bound. It advocates strongly that *all* teachers become more engaged with educating and teaching to high standards those students who focus on career and technical studies.

SREB specifies the following as key practices in order to become affiliated with High Schools That Work:

- High expectations for student learning
- Rigorous career and technical courses
- More required academic courses
- Learning in work environments
- Collaboration among academic and career and technical teachers
- An individualized advising system
- Active encouragement of students' interests
- Extra help outside of school and in the summer
- Use of assessment and evaluation data to improve students' learning

In summary, four macro developments underpin reform in vocational education:

1. Major changes in the economy, which call for major changes in the education and skills of the present and future work force;
2. Greater demand from an increasingly vocal public for new and better education for the nation's youth;
3. New research into student learning and achievement, much of which challenges long-standing practices of how youngsters learn; and
4. Reports from prestigious study and reform groups delineating important and needed changes in high school education.

Perhaps the major implication for career and technical education is that the fundamental philosophy or rationale for its purposes within high schools should change.

Purposes of Career and Technical Education in the 21st-Century High School

The "new" career and technical education is integral to reform of the American high school. The public demands and the students need relevant, contemporary career information, knowledge, and skills. Career and technical education is integral to whole school, comprehensive reform; it is not separate from it.

Drawing from a recent extensive array of research and literature and opinion, the purposes for high school *career and technical education*, for the first 5-10 years of the 21st century, appear to be—

- Providing career exploration and planning
- Enhancing academic achievement and motivation to learn more
- Acquiring generic work competencies and skills useful for employment
- Establishing pathways for continuing education and lifelong learning

In the next section of this paper, the substance to bring about these new purposes for career and technical education will be discussed.

Building a Foundation: The Early Years

> Children exhibit learning capabilities that are shaped by environmental experiences and the individuals who care for them, making the adults who surround them during their formative years—namely, parents and teachers—important players in their development as learners. (Prepublication document from a study by the National Research Council, ***How People Learn: Brain, Mind, Experience, and School***, Bransford, Brown, and Cocking 1999)

The previous section discussed four late 20th-century developments that collectively call for new purposes for high school career and technical education as we launch into the 21st century. That is, the *new* career and technical education is grounded in very significant changes in the economy; citizens' expectations for public schools and especially for the role of high schools in career and technical education; applications from contemporary research on student learning, motivation, and achievement; and new initiatives in school reform, especially at the high school level.

So, what does all of this mean for career and technical education in American high schools as we matriculate into the 21st century? What should our programs look like? To whom should they be targeted? What sort of academic background and educational experiences should students acquire *before* they enroll in high school career and technical education programs or courses? How can the high school's typical core curriculum and career and technical education be better connected? What curriculum frameworks might be offered to public high schools that could be implemented by state and local school boards? How might we improve career and technical education programs and courses to enhance student achievement? The next two sections draw on the previous sections related to the successful history of vocational education and new initiatives from both the American high school reform agendas and new work in career and technical education to present a direction for early 21st-century high school career and technical programs.

The essential foundation for a *new* career and technical education lies in teaching children, youth, and adults to learn and the importance of learning—from the early stages of the womb to the final day at the tomb. This foundation for understanding how to learn and to enjoy learning should be developed very early in a child's life. Relatively new knowledge from science and important research from cognitive psychology can guide parents and early childhood teachers on how to stimulate brain development and thus cognition in very young children.

This is important information for successful 21st-century career and technical education programs as well. Scholars and astute educators continue to emphasize that students are not going to be successful in current and future workplaces (or in higher education for that matter) if they are not prepared well and at a very early age to learn and to continue to learn. Perhaps the most challenging aspects of working in many current high school career and technical education programs has been to figure out how to integrate higher-

level academics with complex technical skills and teach them to students who are poor readers, who lack prerequisite math skills, who don't seem all that interested in learning, and/or who are missing the essential social and collaborative skills needed in contemporary workplaces.

It is strongly proposed that today's and tomorrow's career and technical educators partner early and often with educational colleagues to promote early childhood and parent education, accountability in the early grades to ensure that students are acquiring an appropriate general education, and greater involvement from the total community in the educational experience. In effect, we need to be significant and contributing partners in total school reform. Thus, this section of the paper steps back from the high school years to discuss the early and middle school years as critical in developing a foundation for high school career and technical education.

The Foundation of Early Childhood

Neuroscientists are beginning to study how our neural hardware (how the brain develops and functions) runs our mental software, how our neural circuits enable us to think and learn, and how brain structure supports mental functions. "By the age of three, the brains of children are two and a half times more active then the brains of adults—and they stay that way throughout the first decade of life" (Shore 1997, p. 21). A newborn's brain makes connections at an incredible pace as the child absorbs his or her environment. The richer and more diverse that environment—exposure, say, to a breadth of literature, music, art, conversations with other children and adults, structured play, and creative activities—the greater the number of interconnections that are made to enable learning to take place faster and with greater meaning.

A recent study by the National Research Council (Bransford, Brown, and Cocking 1999; Huang 1999) concluded that infants and young children have a strong predisposition to learn rapidly and readily and thus teaching them early paves the way for competence in early schooling. Children do possess considerable reasoning ability, and teachers need to build carefully on children's backgrounds, (in)experiences, and contexts to influence understanding and further development of reasoning skills. The researchers contend that children can be taught to learn just about anything by sheer will and effort if they are motivated in their own right. Teachers and parents are crucial to the development of children's learning capacities. Children's learning must be supported by adults who direct their attention, structure experiences that help them understand and ask probing questions, and engage them actively in activities that help them reflect on their own learning and understanding.

As the child grows, connections that the brain finds useful become permanent (e.g., as teachers and parents reinforce and build on prior learning) and those that are not useful are eliminated. So as the child is learning the basics—reading, arithmetic, geography, history, technology, science, other languages—useful, permanent connections of the basics with their application in and out of school can greatly be facilitated and strengthened by teacher and parental intervention. The brain selectively strengthens and prunes connections based on experiences. These connections can become very powerful. The

more parents and teachers facilitate them (i.e., through very positive and enjoyable activities), the better and stronger their retention and long-lasting effects. These connections between basic subjects and activities in real-world environments need to be made often by teachers and parents with their children. This process of connection continues throughout our lives, but seems to be most pronounced between the ages of 2 and 11 (Sousa 1995). What is learned (i.e., how much) and sometimes how it is learned [i.e., teachers and parents recognizing a child's primary learning style(s) and adapting teaching processes to accommodate them] in the early years is the greatest predictor for subsequent success in education and in workplaces. Learning, indeed, is the key to earning!

This foundational work from neuroscience combined with years of research from cognitive psychology undergirds the importance of reading early and often to and with children, exposing them to as many aspects of life's rich pageant as possible (sports, music, art, literature, academics, computers, libraries, workplaces, etc.), and socializing them to various age groups, cultures, and environments. The research clearly suggests that an enriched home, great preschool environments, and good "connections" between the subjects taught in school, home, and communities during the early years constitute a critical foundation to continuing education and lifelong learning. Teachers need to teach for meaning and understanding and create learning environments that are low in threat and high in challenge. Students need to be actively engaged with their learning and increasingly immersed in complex experiences as they advance through educational grades. A variety of teaching techniques should be employed to develop and build on individual students' learning styles, backgrounds, cultures, experiences, and preferences.

The importance of early childhood education was strongly emphasized by former President George Bush and the governors who set this as the first of the nation's goals in Goals 2000: Educate America Act, passed by Congress in 1994: "All children in America will start school ready to learn." Parenthetically, apparently one of the greatest stumbling blocks to increased student achievement that continues to surface in conversations with middle and high school teachers and school administrators is that too many students come to them simply not prepared, in the basics, to master higher-level academics. Teachers claim that so many of their students didn't get a solid basic foundation—at home or in school—to prepare them to master challenging subject matter (Goal 3 in the Goals 2000 legislation). At least today, for far too many students, the growing body of research that provides clues for increasing student readiness to learn is simply not applied during the early childhood years in homes, in day care, or even in some structured preschool programs.

Career and technical high school teachers and administrators have expressed concern, too, that they are being pressured to increase academic content in their courses, raise scores on standardized tests of academic achievement among their vocational education students, and be held accountable if their students are assessed as not doing well (see Perkins III legislation). This is unfair, say the teachers, because so many of their students are coming to their classes ill prepared in basic academic subjects—especially reading and math—and thus are not "ready to learn" career and technical education.

They have a point and it is probably a valid one based on studies of students enrolled in 1990s vocational education programs. The latest National Assessment of Vocational Education (NAVE) showed clearly that special population students take more vocational education than other students. NAVE classified special populations as educationally disadvantaged youth (e.g., having low grade point averages or low test scores and often enrolled in remedial courses), economically disadvantaged students—most of whom are also educationally disadvantaged, limited English proficient students, special education students, and unmarried student-parents. NAVE identified 34 percent of the graduating class of 1992 as special populations, but this group completed 43 percent of the total high school vocational credits awarded nationwide that year. In addition to reporting that vocational education was overrepresented with special populations, NAVE also concluded that special populations were overrepresented in vocational schools; greater percentages of them each year were being "dumped" into vocational courses; they concentrated their vocational coursetaking in agriculture, occupational home economics, and the trades; and they were apt to take less coursework in business, health, and the technical or technology areas.

More positively, NAVE encouraged vocational education (now career and technical education) to stay the course with reformed, high-quality programs and ensure that special populations and other students exit these programs prepared to succeed in the work force (Boesel et al. 1994). An implication is that career and technical educators need to lend their voice loudly to those who advocate parent education and reform in early childhood and elementary education to ensure that students arrive in high school prepared to master challenging academics and challenging technical courses. Accountability in public education *must* begin with preschool, early childhood, and elementary education!

Cognitive research also supports that we learn best when we are actively involved with and engaged in interesting and challenging situations or projects and when we converse with others about them. We are then more apt to read about them, dig deeper into their complexities, and draw on a variety of disciplines and tools to continue to learn about them and solve problems connected with them. Thus, elementary and middle school classrooms should be active, engaging, and, yes, fun and challenging places to learn and work. Conversations among children and with their teachers and other adults about students' interests and classroom projects should be the norm.

Some career and technical education needs to be included in the studies of and conversations with elementary school children. Projects and other active learning activities should include workplaces as one of the environments in which knowledge acquisition is applied. Age-appropriate career information needs to be provided to children and the connection between education and its applications in workplaces needs to be reinforced frequently.

In summary, it is absolutely critical that early childhood teachers and parents provide a solid and basic education for children with plenty of exposure to how knowledge is used outside of school environments. This is the critical foundation for all learning that will subsequently be attempted in middle school, high school, college, and throughout life.

The work of those groups focused on preK-6 reform that show increasingly higher levels of student achievement, especially from among at-risk and poor youth, bears examination by all educators and parents to ensure that *all* children learn the basics well.

The Middle School Years

The middle school years, usually grades 6-8 or the 11-14 year-old age range, are equally important to provide a solid foundation for continuing education and lifelong learning, community and citizenship involvement, and career and technical education. Simply put, more is better: more exposure to nonschool environments where learning is applied—through technology, citizenship projects, job shadowing, simulations, conversations with adults from many walks of life, self-analysis relative to future work, education, family, and community activities, etc. The development of a solid and basic education should continue, but with continued exposure to many environments where knowledge is applied.

Exploratory career and technical education should begin in the middle school; that is, more focus on how knowledge is used in workplaces should be infused throughout the middle school curriculum. Students at this age need to research careers, education's connections with careers, the role careers and education play in making meaning of life, and the ever-challenging need to balance career, family, and community life. Lots of student conversations with adults about how knowledge is used in workplaces and communities should take place. Some more specific workplace skills also need to be developed in middle schools, such as those identified with the SCANS report and many technical and computer skills associated with information processing and data management.

Much recent conversation about effective teaching and increased student achievement from career and technical educators addressed the importance of the middle school years in preparing students to master higher-level academic and career and technical courses in high school. For example, the Vocational Education Standards Committee of the National Board for Professional Teaching Standards (1997) recommended that the standards (and thereby the assessment) for highly effective teachers would include knowledge of and skills to work with early adolescents (i.e., middle school youth), especially in areas such as career development and discovery, creating age-appropriate learning environments, and teaching employability skills that should be mastered by middle school students.

Many persons interviewed for this project felt that students who complete middle school should demonstrate that they have mastered basic skills for employment generally identified with the entry-level, "secondary" market (e.g., minimum or near minimum wages, limited benefits, temporary or part-time employment). Typically, skills include cashiering, order taking, work-based communications and literacy (speaking, listening, writing, and reading), telephone etiquette, rudiments of customer service, inventorying and stocking products, basic computer applications, basic arithmetic applications, completing job applications, etc. There also seemed to be reasonable consensus among groups interviewed and in much of the literature that middle school programs ought to include

lessons in technology, keyboarding, computer applications, family and consumer sciences, career exploration, and education and work connections. Many commercial textbooks, state curriculum guides, teacher-developed activities published on various websites, and government-funded materials provide a plethora of age-appropriate work-based learning activities suggested for pre- and early teens (e.g., guidelines and directions for job shadowing, interviews with adult workers, field interviews, company tours, in-school simulations and work-related projects, career papers, etc.). Many also include performance-based tests and other assessments.

Themes and Components of High School Career and Technical Education in the 21st Century

> We believe that isolated institutions or policies that foster categorical thinking or approaches cannot effectively contribute to building a system of youth preparation for employment. Neither can this system be grafted onto secondary-level education. It must be purposefully crafted and infused into all levels and existing sources of schooling, which then must be fashioned to work as a whole. It requires integrated and interlinking components that function over time to produce commonly agreed-on outcomes but that allow for individual support, choice, and success. In this system schools cannot be viewed as stand-alone and independent entities, nor can educators, employers, or community-based organizations. Each must be viewed as part of a broad web of service providers—dedicated, organized, and prepared to assist young people, among other clients, as they move toward adult roles and productive employment. (Council of Chief State School Officers 1995, p. v)

A major focus in preparing this paper was to determine if there is consensus on direction for high school career and technical education as we matriculate into the 21st century. Surprisingly, at least at the conceptual or "big picture" level, there was considerable agreement on primary directions for career and technical education.

Four themes were consistently discussed in the extant literature and seemed to frame much of the discussion of career and technical education. These themes, or unifying representations about needed reform in high school vocational education, were almost ubiquitous in conversations with educators, business persons, and policy groups:

1. The need to infuse career planning throughout the entire curriculum, from preK through lifelong learning. The essence of this theme is that all teachers (and parents) should be cognizant of applications of knowledge to real-world environments, especially workplaces.

2. The need to ground career and technical programs in high school reform. Consistently, respondents spoke of the need to change the way in which high schools are organized, programs and curriculum are delivered, and students are taught.

3. The need to improve the image of and to "upgrade" vocational education into a new and improved career and technical education. Most commented (and much of the literature suggests) that relevant reform initiatives must be important and substantive.

4. The need—expressed quite strongly in the literature and studies about public expectations for educators and students—for high school graduates to be prepared both for workplaces *and* continuing education. Thus many reports reviewed and most people interviewed for the purposes of this report called for a 13th and 14th year as the minimum education benchmarks for the next generation of students.

Drawing on these themes, then, are six components of the education enterprise, each of which should be considered at local and state levels in charting direction for the next decade of high school career and technical education. Four of the components of reform relate essentially to student learning and are thought to provide answers to increasing student achievement. Thus, to prepare students for both employment and higher education, school systems should—

1. Organize programs, curriculum, and instruction around major fields of studies, similar to **majors** typically identified in colleges and universities
2. Bring to scale in high schools more **contextual teaching and learning** throughout the curriculum
3. Infuse considerably more substantive **work-based learning**, ensuring that work-based activities are more solidly grounded in the curriculum and contribute to mastery of standards
4. **Assess *authentically*** student progress toward meeting education standards

Two components relate to the systems or organization of the high school—

5. Increasing the use of **career academies**
6. Adapting at the state or local school system levels the successful models of **tech prep**

Themes

Four overarching themes stand out in the literature review and were confirmed through interviews conducted for this project.

Theme 1. Career Planning and Development

The first consensual theme, and perhaps one that was the most important to the business community involved with this project and to career and technical educators, is to make a vast improvement in career guidance and information delivery throughout public education. Business people seemed to have limited confidence in current teachers and counselors delivering accurate and timely information that helps young people draw connections between education and its uses in workplaces. Most seem to believe that teachers and counselors guide students to consider 4-year colleges as the *only* option to a good career and a successful life and that they do not give students timely and valid information about work, careers, skills for success, career pathways, or options to a baccalaureate degree. All agreed that the *use* of knowledge (e.g., in business and industry) ought to have as much influence in the curriculum as does the assessment of

the accumulation of *theories and facts* of knowledge (e.g., in admissions to higher education).

Thus, an absolute grounding for effective and successful high school career and technical education will be systemic (K-14 through lifelong learning) career planning and development. A school system's career education program will need to be comprehensive and developmentally age appropriate. The essential purposes are to assist students in making and implementing informed education and career choices; to teach them to use a wide array of human, computerized, and written sources of information; and to engage students in career exploration and planning that connects them more closely with "real" workplaces. Generally, educators outline a foundation for K-12 career planning and development and lifelong learning into three broad areas.

The first is **career awareness**, early childhood through about age 11 (fourth or fifth grade), which focuses on schools helping children to see connections of basic subjects with their applications in workplaces, introduction to careers and work, and conversations with adults about work, family, community, and education.

Next is **career exploration**—usually in the middle school grades—which includes more specific information on particular lines of work, industries, clusters, careers, and jobs and their relationship with personal goals, education requirements, and citizenship. The information in middle school is stepped up and more field based. Action-oriented exploration of a variety of workplaces and related education and skill requirements is included in the curriculum.

Students in middle schools should be engaged in many career exploratory activities, including research into careers and preparation of career plans and pathways that are viable options relevant to their own goals and interests. Eighth-grade or middle school exit standards should include assessment of such age-appropriate career development skills as applications of technology, ability to access information(employment databases and career and related education information), decision making, problem solving, self-management, sources of knowledge and information necessary to make meaningful career decisions, basic employability skills, and applications of basic subjects to real-world contexts. Exit requirements would include assessment of skills typically essential for beginning, entry-level, "secondary" employment in major economic sectors. Students would need to pass authentic assessments of these skills to matriculate into high school and career and technical education.

The last phase for the K-12 system, **career preparation**, is a goal of the high school and includes much more focused preparation for workplaces and/or career-related majors in college. Students continue to acquire employability and some specialized skills, especially in technological applications, that will enable them to assume employment upon graduation. Much career guidance continues in high school and students are involved increasingly with work-based learning. A career major is tentatively selected upon entry into high school and finalized by the junior year or around age 16.

Theme 2. High School Reform

> All too often our schools replicate the production system developed during the industrial revolution. People move through school just like a product on an assembly line. We treat students the way we do a machine-made product. Periodically you take samples to see whether there are any errors or mistakes. And if the product doesn't have everything you want, it goes back to an earlier point on the assembly line. Doesn't that sound like a lot of today's schooling? (Former Secretary of Labor Robert B. Reich quoted in ***Business Week***, October 30, 1995)

Most people interviewed for this project, as well as much of the literature reviewed, connect the challenge to improve high school career and technical education with the challenge to improve high schools themselves. Most high schools are too big—way too big, too indifferent, too disconnected with the real world, too rigid with meaningless management (i.e., student-unfriendly) rules and systems, too poorly staffed, too boring, too dangerous, too subject to political and parental pressure (that is why disadvantaged kids are "dumped" into vocational education), too unchallenging (with the possible exception of the few students who are allowed to take advanced courses), too segregated by ability level or tracked, focused on the wrong things, too inattentive to student troubles, and on and on.

Career and technical education at the high school level cannot be reformed independently of other significant reforms in high schools. This draws on the work related to school reform discussed in the section on school reform (see p. 36). There must be a very symbiotic relationship between career and technical educators and their colleagues in other units in the high schools. No longer can "vocational" be separate from "academic" in organizational structure; program, curriculum, and instructional delivery; and in accountability and assessment measures related to students' educational achievement. Nearly everyone interviewed commented that we *cannot* just change "voc ed" without participating intellectually and in meaningful ways to reform other components of the high school systems, curriculum, and instruction.

Most of the suggestions are congruent with the salient features of school reform discussed earlier. Make the high schools smaller, more focused, more challenging with higher standards and authentic assessment, more interesting places to work and study, and more friendly and fair to *all* students and to their parents. High schools need to be more connected with the real world and with adult mentors, provide more resources—especially technology, staffed with well-prepared and dedicated teachers, be more responsive to the communities they serve, be more accountable relevant to their mission and goals, and just be more tuned in to teenagers and their learning and career goals, needs, styles, and problems.

Theme 3. Upgrade "Voc Ed" to a New Career and Technical Education

Now, having said that, a third very pronounced theme is that high school vocational education—in general and in most places—needs to be upgraded considerably to be acceptable as appropriate preparation for workplaces and postsecondary education. This means more contemporary programs organized around the education and training needs of today and tomorrow's industries and career opportunities for students, more rigor, more challenging assignments and projects in and out of classrooms, more reading, more integration of academics, more preparation in technology, more work-based learning, more collaboration with business and industry and with postsecondary institutions, and more accountability for results.

As it now stands, many prestigious colleges and research universities will not consider high school career and technical education coursework favorably in their admission requirements. It is not considered a core subject and is therefore excluded in any formula many colleges use to evaluate applicants. Conversely, most employers interviewed for this project did not consider today's high school vocational education graduates as adequately prepared for substantive or the "primary" employment positions in their firms.

Theme 4. K-14 Model

A final consensual theme to underpin 21st-century high school career and technical education is that postsecondary education needs to be on the radar of all high school students, including those enrolled in career and technical education programs, and their teachers. If the student doesn't plan to go to community or other college immediately after exiting high school, s/he undoubtedly will someday and must be prepared at high school exit to do so. Data consistently show positive correlations between increased levels of education and labor market outcomes. Recent economic forecasts predict that nearly all individuals will need formal postsecondary education, adult and continuing education over their lifespan, and/or strong company training programs to negotiate successfully the envisioned and unforeseen changes in workplaces. The key to negotiate most job changes successfully will be increased levels of education and/or company training. Again, all students need to learn how to learn in order to earn!

The tech prep conceptual model and the articulation of secondary with postsecondary career and technical education were perhaps *the* primary suggestions for reforming vocational education offered by both school and business leaders. A relevant policy question relates to extending a free and public education, K-*14*, for *all* students. It is hoped that governments at local, state, and federal levels will give priority to funding students' voluntary attendance through at least 13 and 14 years of education.

Components

> [A]ll students must be afforded the opportunity to graduate from high school with marketable occupational skills as well as those needed for postsecondary education. An integrated partnership supporting students' varied learning styles is the most effective means of achieving academic and vocational-technical competence needed in a global society. (From a position statement of the National Association of State Directors of Vocational Technical Education Consortium, ***Vocational-Technical Education: Developing Academic Vocational Technical Skills***, n.d.)

The development and implementation of substance and components to underlay the four themes described in the previous section will need to prevail in all states and in all school systems if the twin goals of meeting (1) *all* individuals' needs for a good education and (2) community needs for good citizens and employees/employers are to be realized at levels acceptable to various national and international education and economic sectors. The themes will involve very substantive changes in their components to respond meaningfully to these twin goals, especially relative to policy options and funding.

The remainder of this section addresses high school career and technical education, focusing on six components: high school majors, contextual teaching and learning, work-based learning, authentic assessment, career academics, and tech prep. There seems to be a reasonable consensus among those who are thinking about, researching, writing thought or position pieces on, and/or administering high schools, including career and technical programs, that implementing substantive changes in *each* of these six components will point career and technical education in a relatively new and right direction for at least the first 5-10 years of the 21st century. There are also some data and evaluative studies of initiatives that have been in place for a few years in some states or school systems that help to guide further experimentation, development, and implementation of each of these components.

The components presented address the very core of high school programs and are focused on that which is thought to bring about improvements in students' learning, achievement, and performance to prepare them well for postsecondary education and for workplaces. It is important to note that to bring about substantive changes will involve careful attention to implications from further research and evaluation studies; much developmental work in curriculum, systems, and assessment; and vastly changed and improved teacher education, counselor education, and leadership development programs. Furthermore, the substantive changes cannot be developed and implemented by career and technical educators themselves. "It takes a community to raise a child," it takes parents to raise children, and it will take significant partnering with other educators, business and industry partners, and government agencies to "raise" the next generation of graduates. No one says this is going to be easy, and in fact, the collaboration aspects have been labeled "an unnatural act" by a few interviewed for this paper. Nevertheless, the envisioned development and implementation work seems doable.

Focus on Student Achievement

Component 1: High School Majors

Within both the high school reform agenda and the advancement of career and technical education, consultants and practitioners have proposed to organize high school curriculum into majors. Conceptually, this is similar to the majors that students choose in college around which to organize a program of study, choose specific courses including the arts and sciences and "professional" or applied work, arrange internships and other experiences, complete term or senior projects, and collaborate with advisors, faculty, and other students involved with the major. It isn't just career and technical majors that would be provided to high school students, but focused study and related experiences might surround majors such as the performing arts, the liberal arts, technology, math and science, and education. The specific (i.e., "professional" or "applied") subject matter and experiences should comprise about 10-20 percent—3-4 Carnegie units of credit—of the students' total high school curriculum. It is assumed that all high school students would select a major no later than the junior year or at about age 16.

The system of majors offered by a local high school would replace the current tracking and labeling system that typically identifies students as college prep, general, vocational, and special education. Some schools use even more pronounced tracking by labeling tracks with such elite names as advanced placement and advanced college prep. All students would select a major that presumably is compatible with their personal and career plans, and their interests should align closely with the subject matter and experiences available through the major. Students from all majors would converge to study many academic subjects such as language arts, math, and science.

For career and technical education purposes, the majors available at any high school should be determined at the state and local levels. Policy groups and school administrators should consider the following criteria for organizing career and technical majors:

- A mission to provide the foundation for long-term employment and lifelong learning
- High-growth employment industries and occupations that offer high wages, good career opportunities for graduates, and a clear pathway to advancement
- Requirements for a rigorous, coherent, sequenced program of study that includes high-level academics, technology applications, a recognized body of knowledge by industry standards, infusion of employability skills, work-based learning, and instruction in all aspects of the industry
- Connections with business and industry
- Connections with postsecondary education
- Recognition at key points (e.g., high school graduation) with a transcript delineating accomplishments and/or a skill certificate based on valid and reliable assessments

There are many examples of organizational schemata around career clusters or majors throughout the United States and in other countries known for their effective vocational and technical education systems. Obviously, many of these programs or career cluster areas could be transformed into bona fide high school majors using these criteria.

For example, there are today's high school vocational education program areas that historically were specifically funded by the federal government: agriculture, business, family and consumer sciences, health, marketing, technical, technology education, and trade and industrial. Although the business community did not widely support retention of *some* of these program areas in U.S. high schools, nevertheless they are one schema around which to organize high school majors.

The National Board for Professional Teaching Standards (1997) has built and expanded on these traditional program areas by identifying seven broad economic sectors plus technology education from which to test teachers' knowledge of subject matter:

- Agriculture and environmental sciences
- Arts and communications
- Business, marketing, information management, and entrepreneurship
- Family and consumer sciences
- Health services
- Human services
- Manufacturing and engineering technology
- Technology education

The NBPTS' Vocational Education Standards Committee chose these seven economic sectors and technology education because members felt that nearly all current career and technical education teachers in U.S. middle and high schools offer instruction to their students in at least one of the related career clusters or program areas. Teachers who instruct students in any of these sectors are expected to demonstrate their knowledge of in-depth aspects of that particular industry plus a breadth of knowledge that cuts across all aspects of the industry—planning, management, finance, technical and production skills, underlying principles of technology, and related labor, community, health, safety, and environmental issues in the particular sector (NBPTS 1997).

A relatively new framework for employment training and for consideration by educators, from the National Skills Standards Board, consists of 15 large economic sectors, which taken together account for virtually all paid employment in the United States <www.nssb.org>:

- Agriculture, forestry, and fishing
- Business and administrative services
- Construction
- Education and training
- Finance and insurance
- Health and human services
- Manufacturing, installation, and repair
- Mining
- Public administration, legal, and protective services
- Restaurants, lodging, hospitality and tourism, and amusement and recreation
- Retail trade, wholesale trade, real estate, and personal services
- Scientific and technical services

- Telecommunications, computers, arts, and information
- Transportation
- Utilities and environmental and waste management

In June 2000, the U.S. Department of Education introduced 16 career clusters that educators can use to begin to assess how their school systems can address the academic and career needs of all students. According to Secretary of Education, Richard Riley, the career cluster initiative "redefines vocational education to prepare young people for 21st century jobs by establishing the link between the knowledge they acquire in school and the skills they need to pursue their dreams." The career clusters with brief descriptions are as follows:

- **Agriculture and Natural Resources**. Planning and managing agriculture, food, fiber, wood products, horticulture crops, and other plant and animal products. Financing, processing, and marketing and distribution of agricultural products; farm production and supply and service industries; horticulture and landscaping services, and the use and conservation of land and water resources; development and maintenance of recreational resources. Also includes mining and extraction operations and related environmental management services.

- **Arts Audio-Video Technology and Communications**. Designing, producing, exhibiting, performing, writing, and publishing multimedia content including visual and performing arts and design, journalism, and entertainment services.

- **Business and Administrative Services**. Planning, managing, and providing administrative support, information processing, accounting, and human resource management services and related management support services.

- **Construction**. Designing, planning, managing, building, and maintaining physical structures and the larger built environment including roadways and bridges and industrial, commercial, and residential facilities and buildings.

- **Education and Training Services**. Planning, managing, and providing education and training services and related learning support services including assessment and library and information services.

- **Financial Services**. Planning, managing, and providing banking, investment, financial planning, and insurance services.

- **Health Science**. Planning, managing, and providing diagnostic, therapeutic, and information and environmental services in health care.

- **Hospitality and Tourism**. Planning, managing, and providing lodging, food, recreation, convention and tourism, and related planning and support services such as travel-related services.

- **Human Services**. Planning, managing, and providing human services including social and related community services.

- **Information Technology Services**. Designing, developing, managing, and supporting hardware, software, multimedia, and systems integration services.

- **Legal and Protective Services**. Planning, managing, and providing judicial, legal, and protective services including professional and technical support services in the fire protection and criminal justice systems.

- **Manufacturing**. Planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance, and manufacturing/process engineering.

- **Public Administration and Government**. Planning, managing, and providing government legislative and administrative and regulatory services and related general purpose government services at the federal, state, and local levels.

- **Retail/Wholesale Sales and Service**. Planning, managing, and performing wholesaling and retailing services and related marketing and distribution support services including merchandise/product management and promotion.

- **Scientific Research, Engineering, and Technical Services**. Planning, managing, and providing scientific research and professional and technical services (e.g., physical science, social science, engineering) including laboratory and testing services, and research and development services.

- **Transportation, Distribution, and Logistics Services**. Planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional and technical support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.

The U.S. Department of Education is developing curriculum frameworks in some of these career cluster areas. The frameworks are being developed through a coalition of employers, organized labor or incumbent workers, and career and academic educators at the secondary and postsecondary levels. The integrated academic/technical curriculum is designed to prepare the learner to meet both the requirements of postsecondary education and the expectations of employers. It includes a range of challenging math, science, communications, analysis, technical, and technology skills. The frameworks must be based on existing industry and state academic standards. Models are to be developed from the curricular framework to include specific content, strategies, and materials that teach and assess student competence in the academics, technical knowledge, and skills needed for the cluster.

Many states also have or are developing a version of high school career and technical education majors that is based on either history or a contemporary assessment of that state's employment needs and career opportunities for students. Other countries also have used some form of industry or career framework to organize programs and curriculum (i.e., a major) for their vocational and technical education systems (Hoachlander 1998; Lynch 1997). Regardless of the career-based framework, it is important that (1) the high school major be organized in consideration of the six criteria identified on p. 55 to be credible with employers and with postsecondary educators, and (2) the decision on which and how many majors to offer in the high school is left to local or state policy groups.

Component 2: Contextual Teaching and Learning

> Mr. Sanders has concluded that teachers are the single most important influence on student progress, an even greater determining factor than socioeconomic status. Simply put, he has found that the effect of a bad teacher, or two consecutive bad teachers, can stick with a child for years. Conversely, the influence of a good teacher can still be seen years down the road. At the same time, he's found that effective teachers can push students to make significant gains, regardless of their schools' location. (Jeff Archer, ***Education Week***, May 5, 1999, citing the research of William L. Sanders, statistician from the University of Tennessee, on teacher value-added assessment)

In the two preceding sections of this paper, some current research and theory on cognition and learning were presented. We simply know more today about how students learn, remember, think, perceive, form associations, transfer knowledge, and make sense out of that which they read about, see, hear, and perceive. The contemporary knowledge bases on brain research, child development, learning theory, pedagogy, instructional technology, and assessment have exploded.

Much of the current theory and research is quite supportive of the practices or pedagogy identified historically with career and technical education, especially that related to the contextualization of learning. Our academic colleagues can learn much from our history of practical applications in real-world or simulated contexts. We need to be adamant in our advocacy that abstract academic education unconnected to career or real-world contexts can be satisfying only to those students who are absolutely certain they will complete at least a 4-year college degree and that this degree and/or immediate graduate study will meet their career preparation needs. Most students need context to understand, learn, and remember. Conversely, others are asking us, as career and technical educators, to step up our theory base in classrooms to reinforce the academics that must provide the foundation for applications in workplaces and other contexts. Thus, there is the continuing thrust from policymakers and various constituents to *integrate* academic and applied instruction.

Cognitive science research has major implications for teaching and learning in career and technical education, as well as for some important changes that need to be made in this profession relative to its teaching force of the 21st century. One way to better understand new iterations of research and applications to career and technical education is to contrast them with the traditional view of vocational education. The following chart contrasts the historical literature and philosophy in vocational education (Prosser's essentialism) with the contemporary research and theory most closely identified with constructivism (which builds on the writings of John Dewey) in four areas: clientele, curriculum, teachers, and methods of teaching.

Comparison Area	Essentialism (Prosser)	Constructivism
Vocational education's clientele and relation to community	People who want, need, and can benefit from vocational education should be given the opportunity to do so. Vocational education is closely related to the business, industrial, and economic aspects of the community. Its relations to other social institutions, such as academic education, are less clearly defined. Students should be trained for jobs, not culture.	Interdependence among individuals and the larger world around them. Learners always bring their own personal, social, cultural, work and political histories, purposes, and interpretations with them to the situation, whether they are aware of it or acknowledge it or not. Learning occurs in social situations. Learning occurs best in the community where skills and knowledge will be practiced.
Curriculum	Curriculum contains the essential core of skills and knowledge required for employment. Courses should be built as an orderly sequence leading to successful and predetermined job placement. Newly emerging jobs whose competency requirements are ambiguous ought to be avoided or approached on a risk-management basis.	The most important single factor influencing learning is what the learner already knows; build on prior knowledge. Integrated subject matter focusing on themes and how different content areas address that theme to assist students in making connections. Integration of academic and vocational education. Attention to metacognition and strategic self-regulation. Awareness of the importance of social context such as the difference between vocational (applied) math and formal math with an attempt to use the applied to teach the formal.

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Comparison Area	Essentialism (Prosser)	Constructivism
Teachers	Master of the occupational skills. Primarily tradespeople. Should be fact oriented with latest technical developments in their area of expertise. Teacher "training" to include only the essentials to meet immediate needs of beginning teachers.	The focus of teacher education is not just teachers' knowledge of the subject matter and pedagogy, but teachers' beliefs, conceptions, personal theories, experience related to subject matter, teaching, and learning. Teachers are facilitators of students who are building their own knowledge. The teacher is viewed as a coach who provides more direct instruction at first, which gradually fades as students become more proficient at problem solving. Teachers model, mediate, and scaffold. Teachers engage in diagnostic teaching and attempt to remedy learner errors and misconceptions. Teachers engage in lifelong learning.
Methods of teaching	Vocational learning should correspond to reality. Basic skills and technical knowledge are to be learned and applied exactly as they would be in a real employment situation. Lecture and demonstrations are particularly efficient. Teach single concepts and skills. Amenable to teaching machines.	Facilitate individual, personal learning. Learning is social, experiential, and active, thus emphasis on discussion, collaboration, negotiation, and shared meanings. The use of multiple representations of concepts. Broker much of learning with other persons, tools, and symbolic and physical environments.

Source: Modified from Lynch (1997).

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A few implications from cognitive science, learning style, and higher-order thinking research that affect instruction in high school career and technical education classrooms are presented here. When students come to the career and technical portion of their high school major, teachers should—

- *Build on what they know and help them organize their new knowledge* with that which has already been learned by using concept maps, analogies, concrete instances, rules or guidelines, scenarios, and predictions (Johnson and Thomas 1992).

- *Teach knowledge and skills in meaningful and multiple contexts* such as those embedded in students' culture, workplaces, families, and communities. Expand the learning environment beyond that in the learner's immediate focus. Context is critical to understanding (Borko and Putman 1998; Brown, Collins, and Duguid 1989; Caine and Caine 1990).

- *Create a supportive climate.* Nearly all students learn more and apply more if taught in environments and by teachers who are essentially nurturing, positive, pleasant, reinforcing, and build on knowledge already learned. It is critical for teachers (and others) to understand, however, that a supportive environment is not synonymous with a permissive one.

- *Engage students in active learning processes,* such as problem solving and critical thinking, to help them develop personally relevant learning patterns (Caine and Caine 1990). Draw on metacognitive processes such as reading with students, asking open-ended questions, working with them on technology applications, and having then summarize, explore, and investigate (Johnson and Thomas 1992).

- *Draw upon the personal world of the learner* to expand memory functions and use a multifaceted approach to teaching that allows for uniqueness. Coordinate student learning experiences to draw upon and reflect simultaneous processing of all brain functions. Help students draw meaning from their experiences (Caine and Caine 1990; Thomas 1992).

- *Increase knowledge acquisition and use* through higher-level thinking, knowledge transfer, ability to collect, analyze, and synthesize information and data from multiple sources and viewpoints (Howey 1998).

- *Involve youngsters more directly in their own learning,* which tends to make lessons personally meaningful and memorable. Seminars, cooperative learning, debates, field experiences, laboratories, and independent studies are examples of appropriate techniques (National Association of Secondary School Principals 1996). Community service and work-based learning projects are especially powerful and motivating (Howey 1998).

- *Draw heavily on research and best practices from the literature on classroom methods.* Classroom workshops, small-group activities, cooperative learning, structured groups

and teams, reflective assessments, integrative units, use of technology and art, coaching etc., are part of the best teachers' repertoire of effective classroom practices.

- *Recognize and then assess the different learning styles present in the classroom.* If individual achievement is to improve, then individual learning styles must be carefully diagnosed and (at least some) very different learning prescriptions will need to occur.

- *Collaborate among teachers, disciplines, and students* (Stasz, McArthur, Lewis, and Ramsey 1990; Thomas 1992).

- *Provide instruction that is integrated and project oriented,* not divided into smaller units and 45-minute periods (Berryman and Bailey 1992).

University of Georgia faculty recently identified the major differences between their version of "old-fashioned" or traditional approaches to teaching and learning and new knowledge about contextual teaching and learning. Note that the two extremes represent different ends of a continuum between passive, dependent learning and the more contemporary theories of highly active, engaged learning.

Traditional Teaching and Learning	Contextual Teaching and Learning
Students are passive recipients.	Students are actively engaged.
Students regard content as having no relevant application.	Students view learning as relevant.
Students work in isolation. Peer review and/or discussion is absent.	Students learn from one another through cooperation, discourse, teamwork, and self-reflection.
Learning is abstract and theoretical.	Learning is related to "real-world" and/or simulated issues and meaningful problems.
The teaching is considered the sole arbiter of student learning.	Students are encouraged to take responsibility to develop and monitor their own learning.
Little or no consideration is given to the experiences and backgrounds of the students.	Appreciating students' diverse life contexts and prior experiences is fundamental to learning.
Students expected to wait to become involved in social improvement.	Students are encouraged to become active participants in the improvement of society.
Learning is assessed in a singular standardized format.	Student learning is assessed in multiple ways.
Students' perspectives are not solicited or are undervalued.	The perspectives and opinions of students are valued and respected.
Teacher controls and dictates all aspects of instructional environment.	Teacher acts as a facilitator of student learning.
Teacher displays a limited repertoire of teaching techniques, primarily lectures and recall questions.	Teacher employs a variety of appropriate teaching techniques.

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Traditional Teaching and Learning	Contextual Teaching and Learning
The learning environment is routine and predictable.	The learning environment is dynamic and exciting.
There is overreliance on rote memorization in approaches to teaching and learning.	Higher-order thinking and problem solving are emphasized.
Little risk and experimentation in approaches to teaching and learning are evident.	Students and teachers are prepared to experiment with new approaches; creativity is encouraged.
Assimilation of content is considered singularly important.	The process of learning is as important as the content that is learned.
Learning occurs in one setting (i.e., the classroom).	Learning occurs in multiple settings and contexts.
Disciplinary content is taught in isolation.	Knowledge is interdisciplinary and extends beyond the boundaries of conventional classrooms.
Teacher is viewed as the primary source of knowledge.	Teacher accepts his or her role as a learner.
Students have limited opportunities to transfer understandings to new situations or contexts.	Learning in multiple contexts allows students to identify and solve problems in new contexts (transfer).
Teacher is the primary source of knowledge —*the* authority.	Teacher brokers knowledge and learning experiences.

Additional theory and research support many of the summary statements made herein about teaching and learning. There is also an extensive body of knowledge from the wisdom of practitioners—those teachers who have demonstrated their effectiveness in classrooms and have chosen to speak about it at teachers' conferences or write about it on the World Wide Web and in textbooks, trade journals, magazines, and newsletters. The Vocational Education Standards Committee of the National Board for Professional Teaching Standards (1997) has published standards for highly effective career and technical teachers and provides some description of what it is those teachers should know and do to advance the achievement of their students to high levels.

The contemporary work from the scholarly and applied community (i.e., the teachers themselves) seems to reinforce the critical importance of a solid education and preparation program for teachers. The historical view of Prosser and the resulting practice, even today, that college degrees are not necessary for career and technical education teachers seem to make no sense and can no longer be supported through any logical, let alone, research basis.

In 1996 and 1997, several groups converged in their thinking about preparing teachers for 21st-century career and technical education programs. The National Association of State Directors of Vocational Technical Education Consortium and the University Council on Vocational Education (now known as the University Council for Workforce

and Human Resource Education) convened task forces and prepared publications delineating the issues and proposing new themes and frameworks for revising teacher preparation. Some of their work was built on broader reform proposals or reform initiatives emanating from the wider arenas of reform in teacher education, such as the National Commission on Teaching and America's Future, Holmes Group, the National Council for Accreditation of Teacher Education, and the Carnegie Forum on Education and the Economy. A national conference was held to discuss the challenges and issues with career and technical teacher education.

In a synthesis of various documents, Lynch (1997) summarized seven reform themes emanating from these discussion groups, reports, and conferences:

1. Increase the supply and academic quality of those entering the career and technical education teaching force.

2. Set high standards for teacher education programs.

3. Improve the academic preparation of career and technical teachers.

4. Authentically assess teacher education candidates.

5. Collaborate with schools, social service agencies, businesses and industries, communities, and other learning environments for educational purposes.

6. Increase funding for career and technical teacher education.

7. Create a new vision for career and technical teacher education.

New principles for career and technical teacher education were prepared, and a model for work-based teacher education (career and technical) was designed. In pulling together the various reports, it became very clear that the education and preparation of 21st-century career and technical teachers were going to have to change significantly for them to be able to work effectively in 21st-century programs and increase the academic and career achievement of their students. Five additional implications were identified (Lynch 1997):

1. All teachers in career and technical education should have at least a baccalaureate degree before beginning to teach in high schools (and postsecondary schools).

2. Collaborative processes must be put in place to prepare the teachers of tomorrow's work force.

3. A broader conceptualization of work-based teacher education is warranted.

4. Each state (or possibly region) needs to establish a commission on professional development to focus on the qualitative improvement of the professional development of career and technical educators.

5. All need to work toward increasing the culture of lifelong learning and lifelong professional development with all aspects of the education profession.

The most significant points to summarize from this section on teaching and learning are as follows:

- The knowledge bases related to student learning and teaching have changed drastically in the last 2 decades;
- The anticipated new knowledge and theory generated by neuroscientists and cognitive psychologists and their applications to teaching and learning are expected to increase dramatically in the years ahead; and thus
- The initial preparation and lifelong professional development of all teachers, but especially career and technical teachers, will need to improve dramatically.

It is becoming so very clear in the educational literature that the professional competence of the teacher is directly correlated with the success of the student. Simply put, teachers who know what they are doing and put this knowledge into practice produce students who also know what they are doing and put their knowledge into practice.

Component 3: Work-Based Learning[1]

A third essential component in improving and developing programs of high school career and technical education is to design and include high-quality, work-based learning experiences as an integral part of the curriculum for all students with career and technical majors. As a side note, most educators and business persons consider it important to include work-based learning experiences for all students in workplaces related to other high school majors as well (e.g., the performing arts, math and science, technology).

Using work environments for educational purposes is not new in the United States. It has its origins in Colonial-era apprenticeship programs, which included a mix of full-time work, on-the-job training, and additional instruction in theory. In the late 1800s, cooperative education programs were established in public high schools to keep students in school and to prepare them for work. Work-based learning has long received support in federal education programs including the Morrill Act (1862), the original Vocational Education Act (1917) and subsequent acts and amendments, and the Higher Education Act. In the early 1900s, engineering colleges used work-based education to coordinate schooling in academic settings with outside practical experience in workplaces. University professional schools preparing practitioners in medicine, law,

[1] Much of this section is extracted from the paper by Lynch, R. L., and Harnish, D. "Preparing Preservice Teacher Education Students to Use Work-Based Strategies to Improve Instruction." In ***Contextual Teaching and Learning: Preparing Teachers to Enhance Student Success in the Workplace and Beyond*** (pp. 129-158). Columbus, OH: ERIC Clearinghouse on Adult, Career, and Vocational Education, and Washington, DC: ERIC Clearinghouse on Teaching and Teacher Education, 1998.

architecture, engineering, and teacher education have long required a combination of school and guided work or practical experience.

In a general sense, work-based learning uses environments outside of the school setting to assist students in making connections between what they are learning in school and how it is used in real-life work activities. The salient factor is *learning* in that the workplace is the context in which to learn. The contemporary concept and definition of work-based learning continue to evolve as school reform efforts address the need to connect schooling and workplaces in preparing all students for future work roles and for lifelong learning.

Contemporary work-based learning is grounded in teaching and learning research emanating from the cognitive sciences, psychology, and pedagogy. Consistent with research from these various disciplines, work-based learning blends into an integrated curriculum the mental and tactile, theoretical and applied, and academic and vocational. This blending appears to result—for most students most of the time—in increased retention of knowledge, deeper understanding of subject matter, and the ability to apply (i.e., transfer) knowledge and skills in ill-structured environments. The effectiveness of blended classroom and work-based activities also draws strength from the psychological and pedagogical principles underlying constructivism, contextual learning, the teaching of concepts and subjects through a variety of methods based on students' preferred learning styles, and authentic assessment. Much of what we know about effective work-based learning has been gleaned through research on learning and training in workplaces.

In 1995, the U.S. Office of Technology Assessment described work-based learning as "learning that results from work experience that is planned to contribute to the intellectual and career development of students" (p. 3). It is critical to emphasize the *intellectual* development of students in that all school-sponsored activities must have solid education objectives and that the work experiences are *planned*. Based on OTA's study, research studies emanating from the National School to Work Office, and the wisdom of practitioners, an operational definition of work-based learning has surfaced:

> Work-based learning is an educational approach that uses workplaces to structure learning experiences that contribute to the intellectual, social, academic, and career development of students and supplements these with school activities that apply, reinforce, refine, or extend the learning that occurs at a worksite. By so doing, students develop attitudes, knowledge, skills, insights, habits, and associations from both work and school experiences and are able to connect learning with real-life work activities.

Work-based learning can include a continuum of experiences that vary in purpose, the type of activities engaged in, the nature of the connection with school, and the investment of time, money, and other resources required of learners, teachers, and employers. The activities may range from structured visits to workplaces, simulated work-life experience, actual paid employment, and bona fide licensed apprenticeship programs. The

activities and programs offered and used must be age appropriate and positioned within the school's career planning and development model.

Hamilton and Hamilton (1997) identified eight types of work-based learning activities typically available for students in K-12 public education:

1. **Field trips**: one-time visits to observe work sites
2. **Job shadowing**: longer-term activities, including multiple visits to observe a worker onsite
3. **Service learning and unpaid internships**: voluntary activities that may or may not have a direct career focus
4. **Youth-run or school-sponsored enterprises**: workplaces created in or by schools to provide experiences producing and marketing goods or services
5. **Youth jobs**: jobs typically open to teenagers, which may not offer structured learning opportunities
6. **Subsidized employment training**: part of a training program supported by federal or state funds
7. **Cooperative education and paid internships**: school-related, paid work experience
8. **Apprenticeships**: long-term, structured work-learning programs leading to certification or licensure.

In addition to these types of work-based learning, clinical internships and practica are also offered by many schools—most often for students interested in learning about or preparing for employment in the health professions, law, medicine, the arts, etc.

There is a long and rich history of positive support for work-based learning, especially the on-the-job apprentice model of learning to prepare teens and "older" students for workplaces. It is used extensively in European countries with very positive results for students, the labor market, and the economy. Students generally begin their coordinated workplace apprenticeship and related school studies at about age 16.

But the apprentice model has never been widely practiced at the secondary level in the United States. Enrollments in school-sponsored structured work-based learning programs have historically been very small; this despite the fact that nearly 80 percent of high school graduates say they have worked for pay at some point during their high school years. And, in fact, much of this unstructured work-based experience, which doesn't include any school supervision, may not be all that great for high school students. A number of studies, well publicized in the popular press, point out that excessive work hours (usually more than 20 hours per week while school is in session) have negative effects on students' grades, sleep, exercise, learning, social behavior, personal

debt, spending, and engagement in school activities. However, these studies have been conducted with students and their employers who are *not* connected with the school's formal work-based learning programs. See, for example, ***Protecting Youth at Work*** (National Research Council/Institute of Medicine 1998).

Results from recent studies examining use of structured work-based learning approaches in education provide a positive indication of their impact on student achievement, motivation, and educational continuation. Phelps (1998) cites preliminary evidence from several programs using work-based strategies (e.g., the General Motors partner programs in manufacturing technology, California's career academies) indicating higher grades and class rank and significantly reduced absences among program participants compared to nonparticipants. Participants were just as likely to pursue further education; and, for students with disabilities and those at risk, both better earnings and likelihood of pursuing further education were identified outcomes. Perhaps more important, the work-based teaching approaches used in these programs were found to benefit all students, including the college bound.

Bailey and Merritt (1997) discuss preliminary empirical evidence from program evaluators and researchers who are finding that guided educational experiences outside of the classroom, particularly in workplaces, strengthen and increase the amount of knowledge that is learned, understood, and retained and motivate student interest in continued academic learning. Similarly, the Office of Technology Assessment (1995) concludes that studies of early work-based learning models have shown that they "motivated students, pleased employers, and often had small positive effects on grades, graduation rates, and postsecondary enrollments" (p. 70). According to Steinberg (1998), increased student engagement in learning improves motivation, retention, and achievement. She indicates that the success of work-based teaching and learning strategies seems to be in their capacity to engage students in learning by making connections between work and learning, between "real life" and schooling.

In many of the research and evaluation studies, there appears to be a correlation between the positive student outcomes and the structure that the school and employers put into the work experiences. When the experiences are well planned, implemented, and evaluated relative to the education and career goals and the integrity of the school program—and to some extent, vice versa with the place of employment—the outcomes for all are very positive.

Two recent efforts have researched high-quality work-based learning programs to determine the salient features or components that seem to result in effectiveness. Goldberger, Kazis, and O'Flanagan (1994) identified 10 design elements for work-based learning:

1. **Goals.** Partners formally agree on the goals of the work-based program and how to achieve them. This includes identifying benefits for both students and employer partners as well as resources, roles, and responsibilities for each.

2. **Plan**. Student learning at the workplace progresses according to a structured plan. This includes development of written individual learning plans that state learning objectives and activities and methods of assessment.

3. **Transferable skills**. Work-based experiences promote the development of broad, transferable skills. This means that students learn the social aspects of work processes (e.g., teamwork, time management, communications), develop higher-order thinking and problem-solving skills, and are exposed to all aspects of the industry through job rotations, job shadowing, and onsite work mentors.

4. **School-based activities**. School-based activities help students distill and deepen lessons of work experience. Included here are use of student projects, journal writing, and other customized assignments to explore work-related issues, and academic classes that are organized around work-related themes and applications.

5. **Documentation and assessment**. Student learning at the worksite is documented and assessed. This means that students can demonstrate mastery through authentic, relevant tasks and alternative assessments such as portfolios of student work and performance-based evaluation by worksite experts.

6. **Preparation for workplace entry**. The program prepares students to enter the workplace. This includes orientation by the school or classroom instructor on basic job-related skills and behaviors expected by employers to strengthen student work readiness.

7. **Students receive ongoing support and counseling**. This support can be in the form of formal and informal mentoring by adults in the workplace as well as teacher and counselor monitoring, coaching, and coordination from the school.

8. **Staff support**. The program provides orientation, training, and ongoing support to worksite and school staff. This support can include formal orientation sessions or materials for employers, ongoing meetings, training in pedagogy, and internships or job shadowing in work settings for teachers.

9. **Administrative support**. Structures are established to coordinate and manage the worksite component. This includes designating both a school-based and a worksite-based coordinator for work-based learning to organize and evaluate activities.

10. **Quality assurance**. Mechanisms exist to ensure the quality of students' work-based learning experiences. These include regular review and feedback by participants and external evaluators.

In building on much of the previous work and experience with high-quality work-based learning programs and new research, the Quality Work-Centered Learning Network of Jobs for the Future has begun to identify the dimensions of work-based learning that can be used to establish quality standards for work-based learning experiences developed by schools (Steinberg 1998). These dimensions are especially appropriate as guides for

work-based learning activities designed for younger students. The quality control factors underscore the purposes of work-based learning and highlight some of its benefits to students:

- Experiences are structured around learning goals, agreed to by students, teachers, and outside partners that assist students in reaching standards and graduation requirements.
- Students carry out projects that are grounded in real-world problems, take effort and persistence over time, and result in the creation of something that matters to them and has an external audience.
- Students receive ongoing coaching and expert advice on projects and other work tasks from employers and community partners; by learning to use strategies and tools that mirror those used by experts in the field, students develop a sense of what is involved in accomplished adult performance and begin to internalize a set or real-world standards.
- Students develop a greater awareness of career opportunities in the field and deepen their understanding of the educational requirements of these careers.
- Students develop their ability to use disciplinary methods of inquiry (e.g., think like a scientist) and enhance their ability to tackle complex questions and carry out independent investigations.
- Students are able to demonstrate their achievement through multiple assessments, including self-assessment, specific performance assessments (e.g., oral proficiency exam), and exhibitions.

Component 4: Authentic Assessment

> In the classic Norman Rockwell classroom, tidy students sit in neat rows, listening attentively as a teacher lectures beside a chalkboard. Along with spelling bees and poetry recitations, multiple-choice tests (neat questions, tidy answers) fit perfectly into this nostalgic picture—like pigtails fit into inkwells. (Caudell 1996, p. 4)

The fourth component of teaching and student learning involves improving the authentic assessment of student achievement based on standards, knowledge or content, and effective practices for career and technical programs. This could prove to be tough work and a tough sell to some of the public—and certainly policymakers and politicians—who are familiar with and have come to rely heavily on standardized tests of achievement.

Several years ago, the U.S. Department of Education estimated that American schoolchildren take 100 million standardized tests per year with an average of 100 multiple-choice questions, and thus they fill in 10 billion bubbles annually (Caudell 1996). This is

at a cost of at least $200 million for these tests alone. Examples of the major tests typically used throughout the United States include the Stanford Achievement Tests known best as the Stanford 9, the Iowa Tests of Basic Skills, and the ACT and Educational Testing Service's SAT—used primarily by colleges and universities as one criterion for selecting "qualified" students to admit.

Compatible with the high standards rhetoric and policies, many states are now actively developing their own tests of academic achievement. At least 24 states have recently introduced tests that high school seniors *must* pass in order to get a high school diploma. In addition, 48 states are setting higher academic standards and 34 states have or are developing relatively high-stakes tests in the earlier grades and/or high school subjects in the core curriculum (Chase 1999).

The test results give each student a score (number right) and a percentile ranking (supposedly among peers). The test results give the public and policy groups numerical comparison data and a score from which they can benchmark student achievement. The tests are based on what experts consider to be the knowledge that students of a particular grade or age level should have in content areas from the classical curriculum such as language, mathematics, science, reading, and geography. They almost always are tests of facts and right answers. Sadly, the bubbles on the tests don't always measure what youngsters need to know, the critical thinking they need to master, the problems they ought to be able to solve, and the skills we as a society value. Nor are standardized tools perceived by many segments of the population as "fair" in that, despite gains, women and minorities consistently underperform, especially on SAT scores.

Standardized tests have long been a fact of life in public education and no one seriously expects them to go away. However, once confined largely for the internal consumption of teachers, students, and parents, results are increasingly becoming a public measuring and punishing stick. Scores on these standardized tests have somehow become universal measures of success in the world of public education. Thus the results often pose increasingly high stakes for educators, including career and technical educators.

Voters, parents, politicians, and news outlets want the results disclosed and are quick to seek comparisons among schools, school districts, and states. News media, particularly, seem to delight in treating test results as a major story. Recent articles in many national publications and newspapers cited various groups calling for both punitive measures and rewards based on students' scores on standardized tests: e.g., teacher raises for high scores, principal dismissals for low scores, students admitted to the "best" classes for high scores, students denied graduation for low scores. Further, there is some evidence that school curriculum and instructional practices are being redesigned to up the odds that more students will score higher on the tests. "Teach to the tests." "Use more worksheets and drill." "Practice test taking." "Drill, drill, and more drill." This redesign is irrespective of what it is the students should be learning or even how to best learn it, but may be responsive to what the "experts" (usually drawn from the classical, academic disciplines) say is important knowledge. Sadly, too, the obsession with "one size fits all" testing has probably been encouraged and nurtured by college and university demands for standardized measures to make their jobs easier when selecting which students they

should admit from the pool of high school applicants. The SAT score makes a pretty convenient (and presumably legally defensible) basis from which to decide who does and who doesn't get into the major selective universities.

Perhaps most troublesome about the test mania are two concerns: (1) much of the practice of standardized testing flies in the face of knowledge about student learning and effective teaching, and (2) standardized tests are increasingly being used or vaunted as the *only* measure that really counts in assessing student achievement.

It is proposed herein that career and technical educators give increased attention in the first decade of the 2000s to advocate forcefully for the increased use of multiple, authentic assessments to measure student achievement. It is not that we should argue that standardized tests of academic achievement are not appropriate, but that they are not enough. Compatible with ***Breaking Ranks: Changing an American Institution*** (NASSP 1996), career and technical educators need to ensure that high schools "assess the academic progress of students in a variety of ways so that a clear and valid picture emerges of what [students] know and are able to do" (p. 54).

Authentic forms of assessments provide valid and qualitative information to determine if indeed students are measuring up to standards and can demonstrate knowledge and application of that which they are expected to learn. Assessment of student work should provide a rich collection of information, artifacts, projects, work-based experiences and employer evaluations, rewards and awards, skill certificates, and, yes, standardized tests of both academic *and* career and technical achievement. Many authentic assessments should include a variety of techniques designed to correspond as closely as possible to real-world expectations and experiences.

The National Association of Secondary School Principals has published five standards by which to judge the quality of classroom *and* standardized assessments (Stiggins, Webb, Lange, McGregor, and Cotton 1997):

> Standard 1: High-quality assessments arise from and accurately reflect clearly specified and appropriate achievement expectations for students.
>
> Standard 2: Sound assessments are specifically designed to serve instructional purposes.
>
> Standard 3: High-quality assessments accurately reflect the intended target and serve the intended purpose.
>
> Standard 4: High-quality assessments provide a representative sample of student performance that is sufficient in its score to permit confident conclusions about student achievement.
>
> Standard 5: Sound assessments are designed, developed, and used in such a manner as to eliminate sources of bias or distortion that interfere with the accuracy of results.

Examples of multiple assessments typically include "scores" or evaluative commentary from portfolios, demonstrations, oral and written reports, work-based activities, student productions, term papers or projects, essays, student critiques of literary and technical work, paper-and-pencil tests, employers' and teachers' formal and informal observations, case study analyses, and so forth. Assessments should represent a history (i.e., over time) of learning, organized progress of accomplishment, a direct and valid outgrowth of the standards and objectives set for the curriculum or learning event, and input from multiple human resources. Learners themselves should have input into the assessment processes and some selection of assessment instruments.

Authentic assessments and other high school records of student behavior and performance may become increasingly important in the hiring process. The National Alliance of Business set a goal of over 10,000 employers using secondary school records as a part of the hiring process by mid-1999. The nation's teachers' unions, the National School Boards Association, and the NASSP are supporting NAB in sending this message to students that business does care about what they learn and how well they learn it ("Making Academics Count" <http://www.bcer.org/macc/>; ***Vocational Training News***, February 11, 1999).

Increasingly, authentic assessments are being developed specifically from the knowledge and skills needed in workplaces. For example, thousands of high school students, many of them career and technical education students, have been tested in the past few years with WorkKeys. Developed by ACT in consultation with educators, employers, and those involved directly with employment training and human resource development, WorkKeys provides assessment profiles of students' skills in applied mathematics, applied technology, listening, locating information, observation, reading for information, teamwork, and writing. WorkKeys also provides a job analysis system that determines the levels of skills required for competent performance in specific jobs, as well as an assessment profile and level of competence of people's employability skills relative to those jobs. Nationwide, nearly 14,000 companies have used WorkKeys for the purposes of initial hiring, training, and employment (***ACTivity*** 1999).

Often a license or a performance certificate is awarded if the student demonstrates successful mastery of the curriculum and the requisite career and technical skills. For example, Cisco Networking Academy Program teaches and certifies high school (and college) students to design, build, and maintain computer networks. This certification is based on student mastery of industry standards through various computer-based demonstrations, design and network management projects, and internships. This arena of authentic, work-related assessment has great potential for measuring student achievement and should be advocated strongly by career and technical educators and included in their accountability reports to school administrators and policy groups.

Focus on Organization of Local/State Systems

Component 5: Career Academies

One of the more interesting conversations with both business persons and educators for this project was about career academies. For the most part, those interviewed knew little about them. Some had an awareness of separate vocational high schools in some cities and of area vocational centers favored by some consortia of school districts. Others seemed vaguely familiar with similar kinds of schools with such different nomenclature as career magnet schools, specialty schools, theme high schools, regional occupational centers, and other interesting names.

Most viewed these high schools as places where youngsters were "sent" who in all likelihood would not attend college after completing high school, needed to learn a trade to sustain a living, might drop out if they had to remain in the current high school with its didactic style of instruction, and/or just weren't adjusting well in the regular or comprehensive high school. Without question, enrollment at the vocational high school was perceived by those interviewed as being for someone else's kids. There were some exceptions to this negative take on "career" schools, but the positive perception seemed to appear if the academy was closely aligned with the classical curriculum, such as an academy for the performing arts or an academy for math and science, or if the person interviewed had been a student at such a vocational or career high school many years ago.

Several business persons and educators interviewed and some recent studies support revitalizing vocational high schools or area vocational centers into **career academies** and changing names and descriptors to reflect the academy model. In some school districts, a high school career academy might be a separate or distinct building near or distant from the comprehensive high school or a "school within a school" with a separate wing, floor, or section identified as the career academy.

In reviewing recent evaluative studies, it appears as though successful career academies (and, incidentally, those identified with the classical curriculum, as well) throughout the country have at least five characteristics in common: (1) clusters of students who share many of the same classes each day and have some of the same teachers from year to year; (2) academic courses that meet high school graduation and college entrance requirements; (3) career and technical courses sufficient to comprise a career major; (4) work-based learning experiences built into the curriculum; and (5) a group of business persons who advise the school district on important components of the program such as curriculum, work-based learning, financial aspects, specific courses to offer, and equipment needs.

In current career academies, the teachers from both academic and career and technical fields usually teach the same group of students for 2-3 years, engage in group curriculum and program planning, collectively advise the students on career and education goals, and focus the curriculum around a particular industry. Typically, in today's academies, about 50 students are enrolled in a particular major at each grade level. The academies

are designed to ensure that their graduates are academically and technically proficient, have marketable job skills, and are academically prepared to enroll in postsecondary education (Dayton 1999; Kemple 1997; Raby 1995; Stern, Dayton, and Raby 1998; personal interviews).

Some of the academies are directly sponsored by business groups or professional associations, such as Academies of Finance in New York City, which was developed in partnership with American Express, which subsequently joined other companies to create the National Academy Foundation. Other examples are New York City's Academy of Travel and Tourism, Academy of Public Service, and the Academy of Manufacturing Services. Philadelphia has over 4,000 students enrolled in academies in 28 high schools. The National Academy Foundation serves over 6,000 students in more than 100 high schools throughout the country. California's 200 academies serve over 10,000 high school students in 25 career fields such as electronics, health, business technology, computers, agribusiness, media, environmental science, retailing, graphic arts, and law and government (Raby 1995; Stern et al. 1998).

There is not a great deal of large-scale, quantifiable, longitudinal macro-level or national data that prove career academies (or similarly focused themed high schools) are causing significant increases in student achievement as measured by standardized tests. Most of the studies have been completed on New York City's magnet or themed high schools and California's network of 200 academies. The Manpower Demonstration Research Corporation (Kemple 1997) began a longitudinal evaluation of the career academy approach in 10 sites around the country in 1993. In general, the collective findings, especially from interviews with and survey data from students and teachers about their perceived satisfaction with the academies, have been fairly impressive.

Katz, Jackson, Reeves, and Benson (1995) reported that the studies of New York City's magnet schools and NCRVE's studies are generally positive. In profiling New York City's Aviation High School, the High School of Fashion Industries, the Manhattan Center High School for Science and Mathematics, and the George Washington Vocational Technical High School, the researchers found: "Attendance is high, dropout is low, and discipline problems are rarer than in New York's comprehensive schools...[W]e believe the special focus of each of these schools, and the strong programs each has created around that focus, are largely responsible for their successes" (p. 116). It is perhaps equally important to note that the researchers found tremendous esprit de corps in the schools (among teachers and students); a connection with the essence of the school; a diminishment of racial, ethnic, and gender stereotyping; a feeling of safety and security among all who studied and worked there; cooperative (i.e., team) work projects that were rigorous and drew on both academics and work-based activities; and a frequent description of the school environment as a feeling of "family"—this coming from students, teachers, administrators, *and* the business partners.

More recently, researchers at Teachers College at Columbia University (Crain, Allen, Thaler, Sullivan, Zellman, Little, and Quigley 1999) studied career magnet schools in a low-income city and a ring of older suburbs by examining data files of 9,176 applicants to 59 programs, interviewing applicants, comparing those who were admitted and

graduated with those who were not admitted (i.e., lost the lottery) and graduated from a comprehensive high school, and surveying and interviewing graduates. Six of seven students who were enrolled in or graduated from the academy were African American or Hispanic. The career magnet programs were located either within a regular comprehensive high school or combined with other magnet programs to fill up an entire building. The results were positive, but with some negative or "no differences" findings. For example, there were no significant differences between graduates of magnet schools and comprehensive high schools in standardized test scores, except that career magnets that gave students more time on computers raised student math scores. In this study, career magnet programs had lower graduation rates and higher dropout rates than the comprehensive high schools. According to the researchers, "the low graduation rate seems to be caused by programs setting high standards for their students and, in many cases, pushing weaker students out of the most desirable classes and internships" (ibid., p. iii).

Conversely, graduates of the career magnets earned at least one-third more college credits, chose a college major 1-2 years after graduation, cut class less often, studied more, and had good employment records. Interesting findings were that graduates engaged in fewer high-risk behaviors (e.g., smoking and drinking less, becoming pregnant or causing pregnancy) and the programs seem to have a positive effect on families. Based on these findings (and others), Allen (1999) proposed that career programs be reframed within the context of adolescent identity development, in contrast to relying primarily on work-related skills development.

In assessing the California career academies, Raby (1995) concluded that they should serve as models for both comprehensive and vocational high schools to emulate as they consider curriculum reform. The major successes of the California academies seemed to be students' improved motivation to attend college, preparation for contemporary workplaces, increasing career options, and attendance, grades, and course completion. According to Charles Dayton, director of the Career Academy Support Network, "follow-up surveys have shown that about two-thirds of Academy graduates go on to some form of post-graduate training, and that almost all are engaged in some productive activity by either attending some form of college, working, or doing both" (ibid., p. 2).

In 1993, the Manpower Demonstration Research Corporation (MDRC) began an evaluation of 10 academy sites around the country, 4 in California, 2 in Florida, and 1 each in Texas, Pittsburgh, Baltimore, and Washington, DC. Most of the school districts are in urban areas or small cities and enroll substantial percentages of African American and Hispanic students compared with national averages. The participating school districts also have, on average, higher dropout rates, unemployment rates, and percentages of low-income families.

Two preliminary reports with data aggregated across the 10 sites indicate that these career academies provide their students and teachers with a greater degree of institutional and interpersonal support than is available to their nonacademy counterparts in the same comprehensive high schools. All students surveyed were in the early stages of their academy experiences (two-thirds in their first year and one-third in their second year), so long-term career and educational performance and exit standardized test scores

are not yet available. But the students reported that they are more motivated to attend school and that their schoolwork seems more relevant to their future education and career goals. Academy teachers were more apt to see themselves as belonging to a strong professional learning community, show more opportunities to collaborate with colleagues, and indicate higher levels of job satisfaction than their nonacademy colleagues in the same high schools. Although it is too early in this extensive evaluation and student follow-up process to determine whether the academy will improve student performance, MDRC did conclude that the findings hold much promise for restructuring high schools with the aim of creating more supportive teaching and learning communities for students and teachers (Kemple 1997).

In analyzing published or about to be published data from several studies of career academies, Stern et al. (1998) concluded:

> The evidence to date…indicates that students in career academies have been more academically successful while in high school. The evidence on enrollment in postsecondary education is more limited, but on balance suggests that the academy graduates are more likely than nonacademy graduates to attend college. There is little evidence that career academies give their graduates any immediate advantage in the labor market. In other words, entry-level job training is not what career academies seem to be delivering. Instead, they appear to be helping students strengthen their academic performance, which may improve their career options some years later. (p. 18)

These authors note that academies are expanding nationwide and that some private school systems are developing career academies. They also note that career academies are consistent with many widely accepted principles of school improvement and reform. They caution, and this point should be emphasized, that the expanding popularity of academies could be their undoing. "Education is notoriously susceptible to fads, fashions, and flavors of the month" (p. 25). The processes of building, developing, and nurturing successful career academies take time, commitment to core principles identified with such academies, and infusion of quality control throughout the organization, curriculum, instruction, and delivery of solid work-based and college preparation processes.

Career academies do seem to hold great promise for many high school students, their teachers, and indeed the reform of high schools themselves. It simply makes sense that focused study with like-minded students and teachers, in student-selected interesting and applied subjects, in a small and safe school environment, grounded in adolescent identity development, devoid of social class and race distinctions, and surrounded by supportive teachers and community partners would truly enhance learning. Most of the academies described in the literature are well respected in their communities, are well regarded (and sometimes partially financed) by business or industry, and are considered rigorous and of high quality. The greatest changes in students who attend and graduate from career academies seem to be in their development of much more positive attitudes

with increased interest in learning, planning for the future, awareness of career opportunities and related education expectations, self-confidence, and regard for the academy and its supportive environment.

Today's vocational high schools or area/regional vocational schools ought to consider transforming their current programs into career academies early in the 21st century. But this will need to be substantive transformation—no mere name change or curricular tinkering on the margins. To be successful these academies are going to have to be credible to their constituents (students, parents, community, businesses, higher education) *and* serve students successfully (i.e., prepare them both for college and for careers). They must be perceived as at least equal to, if not superior to, the existing comprehensive high school. A schoolwide age-appropriate career development program, a rigorous program of studies surrounding career majors and a framework for tech prep, and implementation of the characteristics identified with the currently successful career academies must underpin the development of these new 21st-century career academies.

Component 6: Tech Prep

Both business persons and educators interviewed for this project had high praise for tech prep as a conceptual and structural model for high school and career and technical education reform. The model seems to make sense in light of the need for increasingly higher levels of education for all students, the need to connect academic and career and technical education more carefully, and the need to connect secondary and postsecondary curricula to enhance individual student achievement and learning. Most believe that the major goals of tech prep are widely supported by their constituents and the public as a whole. Nearly everyone supports *their* local (meaning the one nearest their home or place of employment) community or technical college and values increased collaboration between it, the local school system, and business and industry to prepare a well-educated and skilled work force.

The original design for tech prep emanated from the thinking of Dale Parnell in his 1984 text, ***Neglected Majority***. Parnell, known as the father of tech prep, called for a significant reform of vocational education based on his observation and some data that voc ed had been relegated in many high school systems as a track for the "educational have-nots" (Hull and Gravelle 1998). Schools in general were neglecting the learning styles, academic needs, and goals of the majority of their students to concentrate resources and teaching methods toward abstract learners who, of course, were or should be college bound. The cynics' rallying cry seemed to be "Educate the best and to hell with the rest." According to Hull and Gravelle (1998), the 1980s saw vocational education in most schools and colleges as "an educational dead end, with few options [for students] to move laterally or upwardly. With few exceptions, students entering (or being placed in) vocational education...had poor academic skills" (pp. 20-21).

The fundamental premise of tech prep was and is that all high school graduates are to be prepared with the foundations in both academic and technical coursework to matriculate into postsecondary education and enter high-skill/high-wage occupations. This was to be the crux of the reform of vocational education.

According to the work of Parnell, Hull, and Bottoms, as well as an analysis of several reports and studies, tech prep seemed to develop throughout the 1980s and into the early 1990s around three major activities:

1. *Articulating programs between secondary and postsecondary education* to result in serious agreements designed to encourage and enhance high school students' matriculation into community colleges, eliminate gaps in both academic and technical education in a "seamless" curriculum from secondary to postsecondary, and restructure course offerings for increased compatibility between high school and postsecondary offerings.

2. *Strengthening academics for all students and using academics as a foundation for technical curriculum.* A major focus in the design of tech prep was to raise the academic achievement of the "neglected majority" in such areas as math, science, and communications. This was to be done in collaboration with the academic community and through increasingly applied courses in academic areas, e.g., applied math, applied physics, applied communications, and principles of technology.

3. *Preparing students for world-class careers.* This goal has been emphasized in any number of ways: broadening career preparation at the high school level (in contrast to narrowly focused job training), preparing students for long-term employment in contrast to entry-level jobs, paying attention to new industries and career opportunities, focusing on advanced learning skills, and enriching the curriculum by including instruction in all aspects of the industry.

In 1990, tech prep received increased impetus with specific funding support by Congress in the Carl D. Perkins Vocational and Applied Technology Education Act (Perkins II). The Perkins II legislation, and especially tech prep, manifested Congress' intention to leverage reform in education for *all* students, but especially for those enrolled in vocational education programs. Tech prep responded to widespread concerns that many, if not most, American high school students were not developing the academic and technical skills they would need to succeed in an increasingly technological labor market and competitive world economy. Perkins II stated explicitly that federal funds were to be used to "make the United States more competitive in the world economy by developing more fully the academic and occupational skills of all segments of the population." This 1990 legislation opened up vocational education federal funding for the first time ever to academic skills and to "all segments of the population." In addition to providing funds to stimulate the development of tech prep throughout the states, Perkins II also provided funds to the National Center for Research in Vocational Education to study the development of tech prep as an education reform.

Summarizing her years of research and that of others as well as some of the theoretical literature, Bragg (1995) from NCRVE identified six core concepts that are forming the basis for developing and implementing solid programs of tech prep:

1. *Tech prep must be grounded in an integrated and authentic (i.e., real-world or simulation of real-world) core curriculum at both the secondary and postsecondary levels.* The core

curriculum—in both secondary and postsecondary schools—must be as rigorous as that traditionally used in the college prep or baccalaureate-transfer tracks, centered on academic subjects, and connected to a broad career cluster (i.e., a major).

2. *There must be formal articulation between secondary and postsecondary schools.* Effective articulation agreements help to create smooth curriculum transitions for students, reduce student failure and dropouts, avoid duplication of content and courses, and lead to higher-quality postsecondary programs.

3. *Work-based learning experiences should be integrated.* This is the bridge between theory and application and draws on the community to assist with student learning. Apprenticeship programs, cooperative education, internships, and clinical experiences are a few examples of structured work-based learning experiences.

4. *Tech prep should be established as a standards-driven, performance-based educational initiative.* This component is responsive to a myriad of forces and concerns about education: ensuring that graduates are learning the "right" things, that assessment is based on published standards and an acceptable level of authentic performance, and that programs are developed consistent with standards, measures, and accountability expectations of legislators and the public.

5. *Tech prep is to be an educational vehicle accessible to all.* Central to this important concept is that education must be universally acceptable in program design and delivery. Tech prep is *not* to be subservient to college prep nor targeted only to someone else's children. Although Parnell originally targeted the "neglected majority" (the middle 50 percent), scholars and reformers since then have cautioned that distinctions not be made among students' abilities and that both the top 25 percent of students (by whatever determining measures are used) and the bottom 25 percent be included in tech prep as well as the "neglected" majority in the middle.

6. *Collaboration is essential.* Joint planning, development, and implementation by a variety of stakeholders are critical to make this reform work and to overcome turf battles. Collaboration can occur when the best interests of students are kept as paramount considerations and the focus is on enhancing student learning and experiences. Bragg concluded: "In the best of situations, a grass-roots local consortium creates the blueprint for tech prep and lays down the foundation for its implementation and continued operation throughout all member organizations [business, industry, labor, parent, student, community]" (p. 299).

Today, the concept and design of tech prep seems to be in good standing with both the business and education communities. No one interviewed, nor any literature reviewed, seriously challenged the philosophy or intent of tech prep and all agreed that it is responsive to both education and business/industry objectives. Unfortunately, there are implementation challenges. The problems have much to do with the proverbial turf wars between secondary and postsecondary schools; the continued belief by some educators, including career and technical educators, that college—even 1-2 years—is really not necessary and that high school "voc ed" really does pay big dividends relative to begin-

ning employment; inadequate resources to develop tech prep programs well at the local (or statewide) level; and lack of attention or commitment from many universities, school leaders, and policy groups. Because of one or more of these or other challenges, few consortia to date have adopted a full-blown tech prep model envisioned by Congress.

There does not appear as yet to be evidence of clear, direct cause-and-effect quantifiable data on the effectiveness of tech prep in terms of its impact on students. About 8 percent of students nationwide participated in something called tech prep in 1995: a total of 737,635 students in 1,029 tech prep consortia (high school, community college, and business partnerships). These consortia included about 70 percent of all school districts, which in turn serve 88 percent of all American high school students (Hershey, Silverberg, Owens, and Hulsey 1998). This is a fast and impressive start-up given the fact that federal tech prep funds were unavailable until 1991. About 58 percent of 1995 tech prep graduates went on to postsecondary education in October of that year, the latest year for which data are available. Presumably, a significant percentage of these would not have gone to college that fall had it not been for the tech prep initiatives. Thus, tech prep probably has contributed to the overall increase in college attendance by American high school graduates, especially by those who concentrated in career and technical education.

Nevertheless, it is difficult to assess tech prep's impact on measured student achievement and direct cause-and-effect for several reasons, but primarily and simply put: Tech prep means quite different things in quite different places. As pointed out in ***The Final Report of the National Tech-Prep Evaluation*** (Hershey et al. 1998), local consortia of schools emphasized different elements of tech prep differently. Only about 10 percent created structured, career-focused, comprehensive programs that integrated academic and career and technical courses, moved to broadly defined career clusters or majors, and grouped students together for career and academic classes. Other tech prep consortia used federal funds primarily to enhance existing vocational programs or advanced just one ingredient of tech prep, such as developing an articulation agreement with a community college or promoting more applied instruction with academic teachers.

Hershey and colleagues did conclude that the creation of tech prep consortia had important benefits such as strengthening local collaboration among educators, increasing emphasis on career guidance in schools, focusing attention on applied forms of academic instruction, and bringing employers more in contact with schools. They emphasized strongly that policymakers make available considerably more financial and other resources to strengthen the development of challenging career-focused programs of study and to provide the necessary services to ensure that students are successful in them.

The findings and conclusion of the 1995 national study reinforced the earlier findings by Hayward and Benson (1993) who reported that those consortia that had been operating 5 years or longer—most doing so prior to federal funding—were advancing greatly in their scope and objectives by getting beyond just articulating existing courses and/or merely providing "advanced placement" at postsecondary institutions. The

consortia that were truly committed to the goals of tech prep were engaging in serious curriculum development, attacking many components designed to improve programs in both secondary and postsecondary institutions, and redirecting core academic courses along a career path.

Further, in 1997, the National Association of Tech Prep Leadership was established to advance the tech prep movement. Composed of individuals who are assuming major leadership roles for tech prep at the local, state, or national level, NATPL is committed to fostering excellence and conducting practical research in tech prep, encouraging cooperative working relationships among relevant education and industry providers, and engaging in short-and long-range planning. NATPL has examined performance measures and standards for tech prep from eight states and drafted program quality indicators to measure tech prep excellence.

From all evaluative studies, as well as the wisdom of observers and practitioners, the general perception seems to be that tech prep has improved considerably the image and programs of vocational education at the high school level. Further, most of the major national professional associations committed to work force education and development have in their own way endorsed the goals and concepts of tech prep as the major education initiative to reform vocational education at the high school level, advance it into a "new" career and technical education, and link it with postsecondary education and work force development.

The 1998 Perkins III federal legislation gave increasing prominence to tech prep through a separate title and increased funding. This title seems again to send a clear signal that Congress and its advisors on education programs prefer the tech prep model with its focus on career and technical education improvement, closely aligned secondary and postsecondary programs, and academic-vocational curriculum integration. Congress also apparently drew on much of the research and literature to overcome some of the barriers to implementing tech prep programs. In summary, the legislation will provide funds to consortia, through a 5-year plan, to do the following:

- Combine 2 years of secondary and (at least) 2 years of postsecondary education in a sequential course of study without duplication of coursework
- Integrate academic, career and technical education, and, if appropriate and available, work-based learning
- Provide technical preparation for careers
- Build student competence in core academic and technical areas
- Lead to an associate or baccalaureate degree or a postsecondary certificate in a specific career field
- Lead to placement in appropriate employment or future education

In approving funding for consortia of tech prep, special consideration is to be given to applications that include job and postsecondary education placement services; are developed with business and industry as a partner; address dropout prevention, reentry, and the needs of special populations; provide education in areas where there are work force shortages; and show how students will acquire high academic and employability competencies (American Vocational Association 1998).

In summary, tech prep appears to be a popular and viable program and curriculum design with school administrators, policy groups (i.e., legislators), business persons, and the general public. Nearly all interviewed for this project promoted the 2+2 plan to articulate high school and community college studies and wished for more collaboration between the two turfs. Effective tech prep programs that will result in improved student achievement, increased college attendance by more high school graduates, and a *solid* career and technical **education** for more youths will take time and commitment to develop from secondary and postsecondary stakeholders, considerable human and financial resources, and careful adherence to the concepts of tech prep identified by Bragg (1995) and others.

Appendix: Background and Methodology

This paper has its origins in discussions by Patricia McNeil with various vocational education stakeholders throughout the nation. "Trish" is the U.S. Department of Education's Assistant Secretary for the Office of Vocational and Adult Education and thus the principal administrator for "voc ed" in the federal government.

The seminal meetings for Trish about new directions or a new "vision" for vocational education were held at the fall 1997 meetings of the National Association of State Directors of Vocational Technical Education Consortium and at the annual convention of the American Vocational Association (now known as the Association for Career and Technical Education). Trish discussed the confusion she often encounters from policymakers and other groups about the contemporary role, purposes, structure, and value of high school vocational education. She posed six questions to members of these associations and other groups as a framework for them to organize their thinking and forward comments to her or her staff:

- Are we in agreement that we need to change and why we need to change?
- Are we in agreement about what kind of knowledge and skills our students need to work and succeed in a high tech/knowledge based economy?
- Are we prepared to deliver the kinds of academic, technical, and SCANS skills needed for a brainpower economy?
- How should vocational education be reorganized at the secondary level to ensure that students get the skills they need to be successful in postsecondary education and the workplace?
- What should be the relationship among vocational education, tech prep, and school-to-work?
- What are the consequences of not addressing these questions?

In the spring of 1998, Trish invited the author of this paper to spend time at OVAE in the Department of Education to create and write a "vision" or "direction" paper for high school vocational education. She asked that a consensus on a vision or, at a minimum, a consensus on direction for high school vocational education be culled out and reported. The author was given essentially free rein, within normal government restrictions, to research and prepare the paper.

Several processes have informed the paper. First, and the one that certainly involved the most time, was reading the extensive references that were amassed from the vocational education historical literature, the contemporary research literature, position papers and monographs from trade and professional associations, the national assessments of vocational education, federal documents—especially the many research documents and survey results describing the annual condition of education and education-work connections, textbooks and papers discussing both economic and education research and trends for the future, journal articles, newspaper articles, and much posting on the World Wide Web.

Next, the author interviewed either by telephone or in person representatives from business and industry, business associations or coalitions, professional education associations, and public schools. Sometimes, these were face-to-face interviews with presidents or chief executive officers or managers or senior staff; usually, it was left up to the business or the association as to who would have the best or most contemporary information or well-grounded opinion. At other times, the author held focus group meetings with several administrators or staffers, most of whom had some experience with education, including vocational or career and technical education.

The following is a listing of the associations—headquartered mostly around Washington, DC—where personal conversations were held and some level of input provided into this paper from board members, officers, managers, or senior staff. Most provided policy-influencing documents or research reports that they considered to have relevance to the future direction of vocational education.

American Association of Colleges for Teacher Education
American Association of School Administrators
American Association of Secondary School Principals
Association for Career and Technical Education
Center on Education Policy
Committee on Economic Development
Committee for Education Funding
Consortium for Policy Research in Education
Council of Chief State School Officers
MPR Associates
National Alliance of Business
National Association of State Boards of Education
National Association of State Directors of Vocational Technical Education Consortium
National Association for Tech Prep Leadership
National Board for Professional Teaching Standards
National Center on Education and the Economy
National Center for Research in Vocational Education
National Policy Association
National School Boards Association
National Retail Federation
National Vocational-Technical Honor Society
Southern Regional Education Board
Vocational Youth Coordinating Council
Youth Policy Forum

The following is a listing of businesses from which executives provided comments, documents, or correspondence related to high school vocational education. Most of these businesses are members of the American Business and Education Partnership, which has its mission to create and put in place infrastructures that support public and private involvement in career and technical education. Most of the representatives from the following companies responded to a direct mail request to the company, a listserv request to members of the partnership or selected other business persons, or a face-to-face solicitation by the author.

A+ Financial Group
Allied Signal, Inc.
Automotive Youth Educational Systems
Betty Crocker Kitchens, General Mills, Inc.
Charles Machine Works, Inc.
Futures Forward
General Motors
Greater New York Automobile Dealer Association
MBNA Hallmark Information Services
Metis Associates
Motorola
National Automotive Technicians Education Foundations, Inc.
National Institute for Metalworking Skills, Inc.
NewsBank
Star Broadcasting, Inc.
The Boeing Company
Wall Street Journal

Conversations were also held, either one on one or in a focus group interview with local school-, state-, or university-level educators. Several provided their local school or state's strategic plan or policy-influencing documents that are designed to chart the future of career and technical education in their area.

Alabama Department of Education
Arkansas Department of Education
Auburn University
Colorado State University
Disney's Teacher of the Year
Idaho Department of Education
Johns Hopkins University, Center for Research in the Education of Students Placed at Risk and the Center for Social Organization of Schools
Kentucky Department of Education
Miami-Dade Public Schools
Minnesota Department of Education
New York Department of Education
Oakland (MI) Schools
Ohio Department of Education
Southern Illinois University
University of California at Berkeley
University of Georgia
University of Idaho
University of Illinois
University of Minnesota
University of Missouri
University of Wisconsin
U.S. Department of Education's teachers of the year (2) and principal of the year
Virginia Department of Education
Virginia Tech
Vocational-Technical Education Consortium of States

Another series of conversations was held with participants at state and national conferences. The author, along with Assistant Secretary Patricia McNeil, presented highlights of this project at all three of the Secretary of Education's 1998 regional conferences, *Improving America's Schools*, held in Portland, Denver, and Nashville; at the fall 1998 conference of the National Association of State Directors of Vocational Technical Education Consortium in Virginia Beach; and at the annual conference of the American Vocational Association in New Orleans.

The author presented at two state conferences (New York Occupational Education Conference and Kentucky's conference of state staff and university vocational education faculty) and obtained feedback, and held a focus group with 14 college and university deans of education at the annual conference of the American Association of Colleges for

Teacher Education. The author also engaged in discussions with participants on e-mail listservs from the state directors of vocational and technical education, faculty/administrators affiliated with the University Council for Workforce and Human Resource Education, those online with the National Center for Research on Vocational Education, and two other lively discussions focused on high school reform and teaching and learning.

Concomitantly, while researching and drafting sections of this report, the author worked in the Office of Vocational and Adult Education, U.S. Department of Education. The considered expertise of OVAE's Deputy Director and staff, Director and Assistant Director of the Division of Vocational Education, several branch chiefs, many education program specialists, and other colleagues contributed immeasurably to this paper by providing historical perspective; access to information and resources; experience and expertise with much of the research and development that underpinned Perkins III, the School to Work Opportunities Act, and the Workforce Investment Act; and many conversations about vocational education and its future. Others in the Department of Education, including those in the Secretary's and other principal offices, the Deputy Director, and those engaged in teacher quality initiatives also provided insightful comments and suggestions.

Finally, the author acknowledges his own experiences and 30+ years of deep involvement with vocational education as a high school student and postsecondary teacher, teacher educator, researcher, and college administrator. The author is well aware that his own experiences, perceptions, and interpretation of the literature and conversations helped to inform (and undoubtedly bias) this paper.

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